2010 Water Quality and Wild Rice Monitoring Report

Prepared for
Essar Steel Minnesota LLC

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2010 Water Quality and Wild Rice Monitoring
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1.0 Background

On October 11, 2007, Minnesota Steel Industries (Minnesota Steel) received a final air permit and authorization to construct and operate the reactivation of the former Butler Taconite mine and tailings basin area near Nashwauk, Minnesota and build a new processing facility to make sheet steel coils from the ore that is mined. In October 2007 Essar Steel purchased Minnesota Steel and formed Essar Steel Minnesota LLC (Essar). Since the purchase of Minnesota Steel, Essar has proposed modifications to increase its taconite pellet capacity to a nominal 6.5 million metric tons per year over a 15 year mining time period. The proposed modifications are referred to as the Essar Steel Minnesota Modifications Project. This increase in pellet production capacity will require 1) the installation of additional crushing and concentrating equipment, 2) a global standard sized indurating furnace, and 3) an increase in the rate of mining. The Department of Natural Resources (DNR) has concluded the proposed modifications require that a State Supplemental Environmental Impact Statement (Supplemental EIS) be prepared in accordance with Minnesota Rules 4410.3000 subpart 3A.

In the preparation notice for the Supplemental EIS, one of the issues identified for study is wild rice surveying and monitoring. This report has been developed to meet the needs of the SEIS as stated in the preparation notice, as follows:

> *Wild Rice. Information on the current presence of wild rice in receiving water bodies from the ESML project will be identified and assessed. Changes to sulfate concentrations for affected water bodies will be modeled. This information will be used to identify potential impacts to wild rice in receiving waters due to changes in sulfate concentrations and/or water levels. Potential adverse environmental effects to water bodies will be identified and monitoring and/or mitigation will be developed to detect changes and to avoid and/or minimize impacts.*

This report contains the following information.

1. A summary of available 2009 and 2010 water quality and hydrologic monitoring data collected on Swan Lake;

2. Available literature review information to determine whether records of historical wild rice harvesting or cultivation exist, and if so to provide a summary of their contents;

3. Initial wild rice survey results to confirm the presence or absence of wild rice in lakes and bays downstream of the Proposed Project;

4. Wild rice survey data (stand size, density and plant height) for those water bodies identified to contain wild rice.

2010 water quality and wild rice monitoring results and information presented in this report were collected based on the technical memorandum entitled: "Essar Minnesota SEIS – Wild Rice Surveys and Water Quality Monitoring Protocol", dated April 9, 2010; revised May 25, 2010 (Barr Engineering) (Wild Rice Study Protocol). Also presented in the report is the 2009 Swan Lake water quality monitoring data from the U. S. Steel Keetac Expansion project EIS.

Water bodies downstream of the Essar project include Swan Lake, Ox Hide Lake, O'Brien Lake, Snowball Lake, and Pickerel Creek (see Figure 1). No wild rice was found in Ox Hide Lake, O'Brien Lake, Snowball Lake, and Pickerel Creek (see Section 3.1 for additional details). In addition to the initial survey results, none of the historical records indicated the presence of wild rice on these water bodies. Per the approved protocol, water quality sampling was ceased and no wild rice counts were conducted on these water bodies following the initial wild rice survey. Water quality data and wild rice survey data for Swan Lake were collected. This report provides water quality data collected through August 11, 2010, as well as wild rice data collected in July and August. Water quality sampling will continue through 2010 until ice forms on Swan Lake. An updated report will be submitted following the completion of laboratory analyses of the last samples collected.

2.0 Water Quality Monitoring

Water quality and hydrologic monitoring are currently ongoing for 2010. Results of measurements collected through August 11, 2010 are presented in this report. A final water quality monitoring report will be generated after 2010 water quality monitoring activities are completed. The purpose of water quality monitoring is to evaluate the concentration of sulfate and corresponding basic water quality parameters (e.g., pH) in Swan Lake. Water quality monitoring activities for 2010 are scheduled to continue until ice formation on Swan Lake occurs (typically November or December). Water quality and hydrologic monitoring data were also collected biweekly by Essar on Ox Hide Lake, O'Brien Lake, Snowball Lake, and Pickerel Creek from June 24, 2010 through July 21, 2010. Essar ceased collecting this data following the completion of an initial wild rice survey on these water bodies which confirmed the absence of wild rice (see Section 3.1).

2.1 Water Quality Monitoring Locations

The water quality monitoring locations are identified in Figure 1. Ox Hide Lake (via Ox Hide Creek), Pickerel Creek, and O'Brien Lake (via O'Brien Creek) discharge into the main body of Swan Lake. Snowball Lake (via Snowball Creek) discharges to the Swan River immediately downstream of where Swan Lake discharges to the Swan River west of monitoring location KSW6. Monitoring location KSW7 is located in a shallow (approximately 2- to 3-feet deep) unnamed bay at the southwest corner of Swan Lake near the outlet to the Swan River. The bay, further referred to in this report as Swan Lake Southwest Bay, is attached to the main body of Swan Lake by a small channel. There are no other substantial inlets or outlets to Swan Lake Southwest Bay.

2.2 Water Quality Monitoring Methodology

Water quality monitoring on Swan Lake was conducted by Barr Engineering on behalf of Essar in 2010. Water samples were collected from water surface at all locations on Swan Lake, and at 4-meter depth intervals at KSW5. Water quality monitoring on Ox Hide Lake, Snowball Lake, O'Brien Lake, and Pickerel Creek was conducted by Braun Intertec on behalf of Essar. Water samples were placed on ice and shipped to Braun Intertec's laboratory in Minneapolis for analyses of sulfate, iron, calcium, and magnesium. Water quality analyses consisted of unfiltered sulfate analysis by ion chromatography method (EPA 9056) and unfiltered total iron, total calcium, and total magnesium analysis (EPA 6010B). Temperature, pH, dissolved oxygen, and ORP were measured with a field probe (YSI® model 556 multiprobe or equivalent). Field parameters were collected at 2-meter intervals in Swan Lake at location KSW5.

2.3 Water Quality Monitoring Results

Results of 2010 sulfate, iron, calcium, and magnesium analyses are summarized in Table 1. Field parameter measurements (temperature, pH, dissolved oxygen, and ORP) are included as Appendix A. In addition to water quality data collected in 2010, 2009 water quality data for Swan Lake are also included (U. S. Steel Corporation Keetac Expansion Project's EIS, *2009 Water Quality, Hydrology, and Wild Rice Monitoring Year End Report.* Data tables summarizing water quality from that 2009 report are included as Appendix B.

To date, sulfate concentrations in surface samples collected in 2010 from the main body of Swan Lake (KSW4, KSW5, and KSW6) have ranged from 18 mg/L to 31 mg/L, and concentrations in Swan Lake Southwest Bay (KSW7) have ranged from 4.8 mg/L to 9.9 mg/L. Sulfate concentrations in Swan Lake from 2009 to present are presented in Figure 2. The ion chromatography analytical method has an error range of 20 percent according to the method documentation, as represented by error bars included on Figure 2.

On two separate occasions, laboratory results for a sample collected on Swan Lake came back with unusually high sulfate concentrations that were inconsistent with sulfate concentrations of other Swan Lake samples collected on the same date: sample "KSW5-4m" collected on 6/10/2010 and "KSW6" collected on 6/25/2010. The laboratory re-analyzed the samples in question, along with several other samples from the same sampling events. In both cases, sulfate results on the re-analysis were within expected ranges and more closely matched sulfate concentrations of Swan Lake samples collected on the same date. Results from other samples that were re-analyzed closely matched the results of the initial analyses. The laboratory believes the unusually high sulfate results in the two samples in question were the result of contaminated sample vials used to feed samples into the ion chromatography analytical machine. The laboratory has since added procedures to rinse the sample vials with clean laboratory water before using it for ion chromatography analyses. No unusual sulfate results have occurred since the laboratory adopted the additional procedure. The laboratory delivered revised reports for samples collected on 6/10/2010 and 6/25/2010 that utilize results from the re-analysis of sulfate.

2.4 Historic Sulfate Concentrations for Swan Lake

Swan Lake has been monitored for sulfate concentrations in previous years by Minnesota Steel/Essar Steel in 2005, 2006, and 2007. Appendix C includes a figure of historic sulfate data collected from the surface of Swan Lake from 2005 through 2009.

3.0 Wild Rice Survey

The purpose of the Wild Rice Survey is to determine the presence of wild rice (*Zizania palustris L*, known as *Manoomin* in Ojibwe), an annual grass, on Ox Hide Lake, Snowball Lake, O'Brien Lake, Pickerel Creek, Swan Lake Southwest Bay, and the Swan River, which flows out of Swan Lake just north of its Southwest Bay (Figure 1) (Study Area). Since wild rice populations oscillate over an approximate 4- to 6-year period, the following analyses and ground surveys were performed to determine past and current presence of wild rice.

1. Literature search to identify if there were historical records of wild rice on the waterbodies potentially affected by the Essar Project.
2. On-the-ground verification of the presence of wild rice and sampling of the density of select wild rice stands.
3. Analysis of historic infra-red USGS photographs for the presence of wild rice in water bodies potentially affected by the Essar Project.

3.1 Initial Wild Rice Survey

An initial wild rice survey was conducted by Barr to determine whether wild rice was present on Ox Hide Lake, Snowball Lake, O'Brien Lake and Pickerel Creek (Figure 3) on the following dates:

O'Brien Lake – July 20, 2010

Ox Hide Lake and Snowball Lake – July 21, 2010

Pickerel Creek – July 21, 2010 and July 30, 2010

Field reconnaissance for the initial survey of O'Brien Lake, Ox Hide Lake and Snowball Lake was conducted on the water surface by boat and on Pickerel Creek by foot. No wild rice was observed on any of these water bodies.

3.2 Wild Rice Survey Methodology

The following section describes the methodologies used in obtaining information and data on wild rice.

3.2.1 Methodology of Literature Search for Wild Rice in Downstream Receiving Waters from the Project

To determine which water bodies downstream of the Essar Project might potentially have wild rice populations, a literature review of historic and cultural information was conducted. Information examined included the 2008 DNR "Natural Wild Rice in Minnesota" Report, U.S. Department of Interior Geological Survey maps (Topo maps), Trygg maps, and the 2010 Wild Rice Management Workgroup "350 Significant Wild Rice Waters in Minnesota." The Trygg maps were developed by J. William Trygg (1966) utilizing data from the original Government Land Surveys along with other historical surveys and sources (http://www.trygglandoffice.com/maps.html). The MNDNR was also contacted by Essar in December, 2009 regarding historical wild rice records. The Wild Rice Management Workgroup is a coalition of federal, state, tribal resource managers and other wild rice stakeholders. The list is periodically updated as was last updated May 4, 2010 (Appendix D).

3.2.2 Methodology of Historic Aerial Photographic Imagery Analysis

Staff from the Sciences and Technologies Branch USGS-BRD-Upper Midwest Environmental Sciences Center in La Crosse, WI analyzed 2004 and 2008 1-meter resolution NAIP (National Agricultural Imagery Program) natural color and color infrared aerial photographic imagery for the presence of wild rice on Swan Lake Southwest Bay and Swan River in 2009. In 2009, wild rice appeared in some of the same locations as those identified in NAIP photographs, but the results were inconsistent with ground surveys and therefore their results inconclusive.

According to USGS staff in follow up phone conversations in 2009, wild rice can be identified with approximately 80 percent certainty under the following conditions: (1) 0.5-meter resolution or better; (2) use of stereo-scope and infra-red photography; (3) density of wild rice approximately 30 percent coverage or greater (density factor 2 through 5); and (4) no more than two species growing next to or mixed in with wild rice. Until this technology improves (includes greater accuracy in identifying wild rice at smaller densities (less than 30 percent)), aerial photographic analysis should not replace ground surveys. As a result, Barr decided not to conduct aerial photographic analysis, but carried out the ground surveys in 2010.

3.2.3 Methodology of Ground Verification and Density/Acreage Calculations

Surveys to estimate wild rice density and crop acreage were carried out the week of August 16, 2010. Qualitative estimates of wild rice coverage were carried out by canoeing along the perimeter of the wild rice beds and recording bed locations using a Trimble® GPS Pathfinder® ProXH™ receiver. Quantitative estimates of wild rice coverage were determined from representative sampling grids 10-

meter x 10-meter size. Four grids were sampled on Swan Lake Southwest Bay in 2009 and again in 2010. A grid will be set up the week of September 7, 2010 on Swan River (Figure 6). As in 2009, a 0.5 m^2 PVC square was placed on the water surface at each randomly selected plot and the rice stems within the 0.5 m^2 square were counted. Height above the water surface was measured for five plants within each 0.5 m^2 plot. Height was measured to the plant's highest point (seed head). Stem count sum, mean, median, and standard deviation were calculated based on the stem count for 20 plots. The total stem count for each grid comprises 10 percent of the grid area. The total area sampled for each grid was 10 m^2 (20 plots x 0.5 m^2 each).

3.2.4 Methodology of Plant Sampling

Additional data to determine differences between plant growth and production within the Study Area were collected. Ten wild rice plants were collected from each grid on Swan Lake Southwest Bay and will be collected from the grid on the Swan River. If sparse stands of wild rice were found in sampling locations, then between 5 to 10 plants were collected in the densest locations. Total plant biomass, root biomass, seed biomass, and seed number will be measured. Basic statistical calculations will be carried out (Table 2 – placeholder).

3.3 Wild Rice Survey Results

The following details the results of the wild rice survey and analyses that have been conducted for Swan Lake Southwest Bay and the Swan River up to the dam (Figures 4 - 6).

3.3.1 Results from Literature Review

No evidence from literature cited in 3.1.1 or other literature resulted in identification of wild rice presence on Snowball Lake, Ox Hide Lake, O'Brien Lake or Pickerel Creek. In a December 29, 2009 e-mail from Mr. Rian Reed of the MNDNR, it was stated that he had reviewed historic MNDNR Fisheries Lake Surveys to determine if wild rice (*Zizania aquatica*) occurred in any of the aquatic plant surveys for Snowball and Ox Hide Lakes. Aquatic plant surveys were taken on Snowball Lake (31- 108) in August 1977 and on Ox Hide Lake (31-106) on 06/26/1978. No wild rice was noted in any of these surveys.

In addition, no wild rice was subsequently found in the initial survey on those water bodies. As discussed in the *2009 Water Quality, Hydrology, and Wild Rice Monitoring Report* for the Keetac Expansion Project, Swan Lake Southwest Bay and Swan River were identified as potential wild rice water bodies.

3.3.2 Results of Ground Verification and Density/Acreage Calculations

Wild rice was identified from ground surveys performed on Swan Lake Southwest Bay and Swan River the week of August 16, 2010 (Figures 4 - 6). The four grids established on Swan Lake Southwest Bay in 2009 were counted the week of August 16, 2010. Swan Lake Southwest Bay had the largest overall acreage of wild rice, while Swan River had less acreage but one very dense stand of wild rice near the dam (Figure 4). A grid was set up on September 10, 2010 in the Swan River (grid 43). Wild rice stands were identified along more than 90 percent of the perimeter of Swan Lake Southwest Bay (Figures 5 and 6). Average plant heights for grids 6 and 7 were 50 and 60 percent taller, respectively, than average plant heights in 2009. Average plant heights for grids 8 and 9, however, were 90 and 82 percent the average height of plants from 2009. Many of the wild rice beds observed in the center of Swan Lake Southwest Bay were populated with between 30 to 75 percent lily pads. Detailed information on results of the on-the-ground wild rice survey is included in Appendix E. Photographs of wild rice taken from Swan Lake Southwest Bay and Swan River are included in Appendix F.

3.3.3 Results of Plant Density and Seed Calculations

[TBA]

3.4 Wild Rice Survey Discussion

Results from the 2010 ground surveys identified the presence of wild rice on Swan Lake Southwest Bay and Swan River. Although wild rice has been documented and several dense stands have been identified for two years on these water bodies, it is difficult to determine the health and history of wild rice in these lakes. Delays in plant nutrient uptake and wild rice tissue chemistry influence wild rice growth and production from year to year (Walker et al., 2006; Walker et al., 2010). Other factors such as water level may also play a role, but no data has been collected over multiple years and published. Other factors such as water level may also play a role, but no data has been collected over multiple years and published.

Grids 6 and 7 had 537 and 524 stems respectively with a mean stem density of 27 and 26 stems/ 0.5 m^2 respectively. Grids 8 and 9 had 187 and 174 stems with a mean stem density of 9 stems each/ 0.5 m^2. The mean stem density for all four grids was 18. Grid 43 had 1713 stems with a mean stem density 86 stem/ 0.5 m^2. Sulfate concentrations measured at KSW7 in Swan Lake Southwest Bay in 2010 have ranged from 4.8 mg/L to 9.9 mg/L. Additional information will be added regarding plant and seed density data. From two year's data examining wild rice density data and water sulfate levels, it is not possible to determine the effects of sulfate on wild rice growth and production.

References

1854 Treaty Authority. 2008. Wild Rice Monitoring and Abundance in the 1854 Ceded Territory (1998 - 2008)

Minnesota Department of Natural Resources. 2008. *Natural Wild Rice In Minnesota: A Wild Rice Study* document submitted to the Minnesota Legislature by the Minnesota Department of Natural Resources February 15, 2008

Walker, R.D., Pastor, J., Dewey, B.W. 2006. "Effects of wild rice (*Zizania Palustris L.*) straw on biomass and seed production in northern Minnesota." *Canadian Journal of Botany*, 84, (1): 1019-1024.

Walker, R.D., Pastor, J., Dewey, B.W. 2010. "Litter Quantity and Nitrogen Immobilization Cause Oscillations in Productivity of Wild Rice (*Zizania palustris L.)* in Northern Minnesota." *Ecosystems*, 13: 485-498.

Wild Rice Management Workgroup (coalition of federal, state, tribal resource managers and other wild rice stakeholders). 2010. "350 Significant Wild Rice Waters in Minnesota." (updated on May 4, 2010)

Tables

Table 1: Water Chemistry Results, 2010
Essar Steel Minnesota LLC **DRAFT**

ES OH WQ1 - Oxhide Lake															
	6/24/2010					7/7/2010					7/21/2010				
Depth (m)	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.
0	29	< 0.020	40	22	190	30	0.024	36	20	172	32	< 0.020	36	20	172

ES SB WQ1 - Snowball Lake															
	6/24/2010					7/7/2010					7/21/2010				
Depth (m)	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.
0	12	< 0.020	27	10	109	11	0.024	24	9.4	99	16	0.022	26	10	106

ES OB WQ1 - O'Brien Lake North															
	6/24/2010					7/7/2010					7/21/2010				
Depth (m)	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.
0	12	0.023	35	18	162	11	0.039	33	17	152	15	0.036	34	17	155

ES OB WQ2 - O'Brien Lake South															
	6/24/2010					7/7/2010					7/21/2010				
Depth (m)	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.
0	6.2	0.023	30	17	145	7.2	0.075	29	16	138	12	0.11	30	16	141

ES PC WQ1 - Pickerel Creek North															
	6/24/2010					7/7/2010					7/21/2010				
Depth (m)	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.
0	9.6	0.34	39	130	633	5.5	0.39	35	110	540	6.5	0.55	38	120	589

ES PC WQ2 - Pickerel Creek South															
	6/24/2010					7/7/2010					7/21/2010				
Depth (m)	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.
0	14	2.5	51	100	539	7.5	1.4	48	94	507	15	1.2	63	82	495

Notes

Sulfate	Concentration of sulfate in mg/L.
Fe	Total iron concentration, in mg/L.
Ca	Total calcium concentration, in mg/L.
Mg	Total magnesium concentration, in mg/L.
Tot. Har.	Total hardness, in mg/L CaCO3.
NA	Not Analyzed
24 *	Concentration is a result of re-analysis after initial result was determined to be an error. Prior result was 39 mg/L sulfate.
21 **	Concentration is a result of re-analysis after initial result was determined to be an error. Prior result was 86 mg/L sulfate.

Table 1: Water Chemistry Results, 2010
Essar Steel Minnesota LLC **DRAFT**

KSW4 - Swan Lake, Southeast															
	5/1/2010					5/13/2010					5/27/2010				
Depth (m)	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.
0	28	< 0.020	33	21	169	24	0.025	32	20	162	24	< 0.020	32	20	162

KSW5 - Swan Lake, Center															
	5/1/2010					5/13/2010					5/27/2010				
Depth (m)	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.
0	29	< 0.020	33	22	173	23	0.020	32	20	162	27	< 0.020	31	20	160
4	31	< 0.020	NA	NA	NA	23	< 0.020	NA	NA	NA	23	< 0.020	NA	NA	NA
8	NA	NA	NA	NA	NA	22	< 0.020	NA	NA	NA	23	< 0.020	NA	NA	NA
12	NA	NA	NA	NA	NA	24	< 0.020	NA	NA	NA	24	< 0.020	NA	NA	NA
16	NA	NA	NA	NA	NA	24	0.024	NA	NA	NA	24	< 0.020	NA	NA	NA
18	NA	NA	NA	NA	NA	23	< 0.020	NA	NA	NA	23	< 0.020	NA	NA	NA

KSW6 - Swan Lake, West															
	5/1/2010					5/13/2010					5/27/2010				
Depth (m)	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.
0	29	0.032	31	20	160	23	0.024	30	19	153	23	0.026	30	19	153

KSW7 - Swan Lake, Southwest															
	5/1/2010					5/13/2010					5/27/2010				
Depth (m)	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.
0	7.7	0.082	20	8.6	85	9.8	0.071	20	8.7	86	9.9	0.088	21	9.6	92

Notes

Sulfate	Concentration of sulfate in mg/L.
Fe	Total iron concentration, in mg/L.
Ca	Total calcium concentration, in mg/L.
Mg	Total magnesium concentration, in mg/L.
Tot. Har.	Total hardness, in mg/L CaCO3.
NA	Not Analyzed
24 *	Concentration is a result of re-analysis after initial result was determined to be an error. Prior result was 39 mg/L sulfate.
21 **	Concentration is a result of re-analysis after initial result was determined to be an error. Prior result was 86 mg/L sulfate.

Table 1: Water Chemistry Results, 2010
Essar Steel Minnesota LLC **DRAFT**

KSW4 - Swan Lake, Southeast															
	6/10/2010					6/25/2010					7/12/2010				
Depth (m)	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.
0	22	< 0.020	33	22	173	22	0.032	30	20	157	25	0.044	31	20	160

KSW5 - Swan Lake, Center															
	6/10/2010					6/25/2010					7/12/2010				
Depth (m)	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.
0	21	< 0.020	32	21	166	22	0.022	32	21	166	25	0.023	32	21	166
4	24 *	< 0.020	NA	NA	NA	22	< 0.020	NA	NA	NA	25	< 0.020	NA	NA	NA
8	23	< 0.020	NA	NA	NA	23	< 0.020	NA	NA	NA	25	< 0.020	NA	NA	NA
12	23	0.024	NA	NA	NA	24	< 0.020	NA	NA	NA	26	< 0.020	NA	NA	NA
16	23	< 0.020	NA	NA	NA	23	< 0.020	NA	NA	NA	26	< 0.020	NA	NA	NA
18	22	< 0.020	NA	NA	NA	24	< 0.020	NA	NA	NA	25	0.024	NA	NA	NA

KSW6 - Swan Lake, West															
	6/10/2010					6/25/2010					7/12/2010				
Depth (m)	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.
0	22	0.023	32	21	166	21 **	0.048	30	21	161	25	< 0.020	32	21	166

KSW7 - Swan Lake, Southwest															
	6/10/2010					6/25/2010					7/12/2010				
Depth (m)	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.
0	8.3	0.110	21	11	98	6.0	0.062	18	9.1	82	6.2	0.086	20	9.3	88

Notes

Sulfate	Concentration of sulfate in mg/L.
Fe	Total iron concentration, in mg/L.
Ca	Total calcium concentration, in mg/L.
Mg	Total magnesium concentration, in mg/L.
Tot. Har.	Total hardness, in mg/L CaCO3.
NA	Not Analyzed
24 *	Concentration is a result of re-analysis after initial result was determined to be an error. Prior result was 39 mg/L sulfate.
21 **	Concentration is a result of re-analysis after initial result was determined to be an error. Prior result was 86 mg/L sulfate.

Table 1: Water Chemistry Results, 2010
Essar Steel Minnesota LLC **DRAFT**

KSW4 - Swan Lake, Southeast										
	7/26/2010					8/11/2010				
Depth (m)	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.
0	26	0.047	30	20	157	20	0.029	30	21	161

KSW5 - Swan Lake, Center										
	7/26/2010					8/11/2010				
Depth (m)	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.
0	25	< 0.020	29	19	151	20	< 0.020	30	21	161
4	26	0.026	NA	NA	NA	20	< 0.020	NA	NA	NA
8	25	< 0.020	NA	NA	NA	20	< 0.020	NA	NA	NA
12	26	< 0.020	NA	NA	NA	21	< 0.020	NA	NA	NA
16	25	0.050	NA	NA	NA	20	< 0.020	NA	NA	NA
18	27	< 0.020	NA	NA	NA	18	0.021	NA	NA	NA

KSW6 - Swan Lake, West										
	7/26/2010					8/11/2010				
Depth (m)	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.
0	25	0.034	30	20	157	19	< 0.020	29	20	155

KSW7 - Swan Lake, Southwest										
	7/26/2010					8/11/2010				
Depth (m)	Sulfate	Fe	Ca	Mg	Tot. Har.	Sulfate	Fe	Ca	Mg	Tot. Har.
0	5.2	0.073	18	8.5	80	4.8	0.072	19	8.9	84

Notes

Sulfate	Concentration of sulfate in mg/L.
Fe	Total iron concentration, in mg/L.
Ca	Total calcium concentration, in mg/L.
Mg	Total magnesium concentration, in mg/L.
Tot. Har.	Total hardness, in mg/L CaCO3.
NA	Not Analyzed
24 *	Concentration is a result of re-analysis after initial result was determined to be an error. Prior result was 39 mg/L sulfate.
21 **	Concentration is a result of re-analysis after initial result was determined to be an error. Prior result was 86 mg/L sulfate.

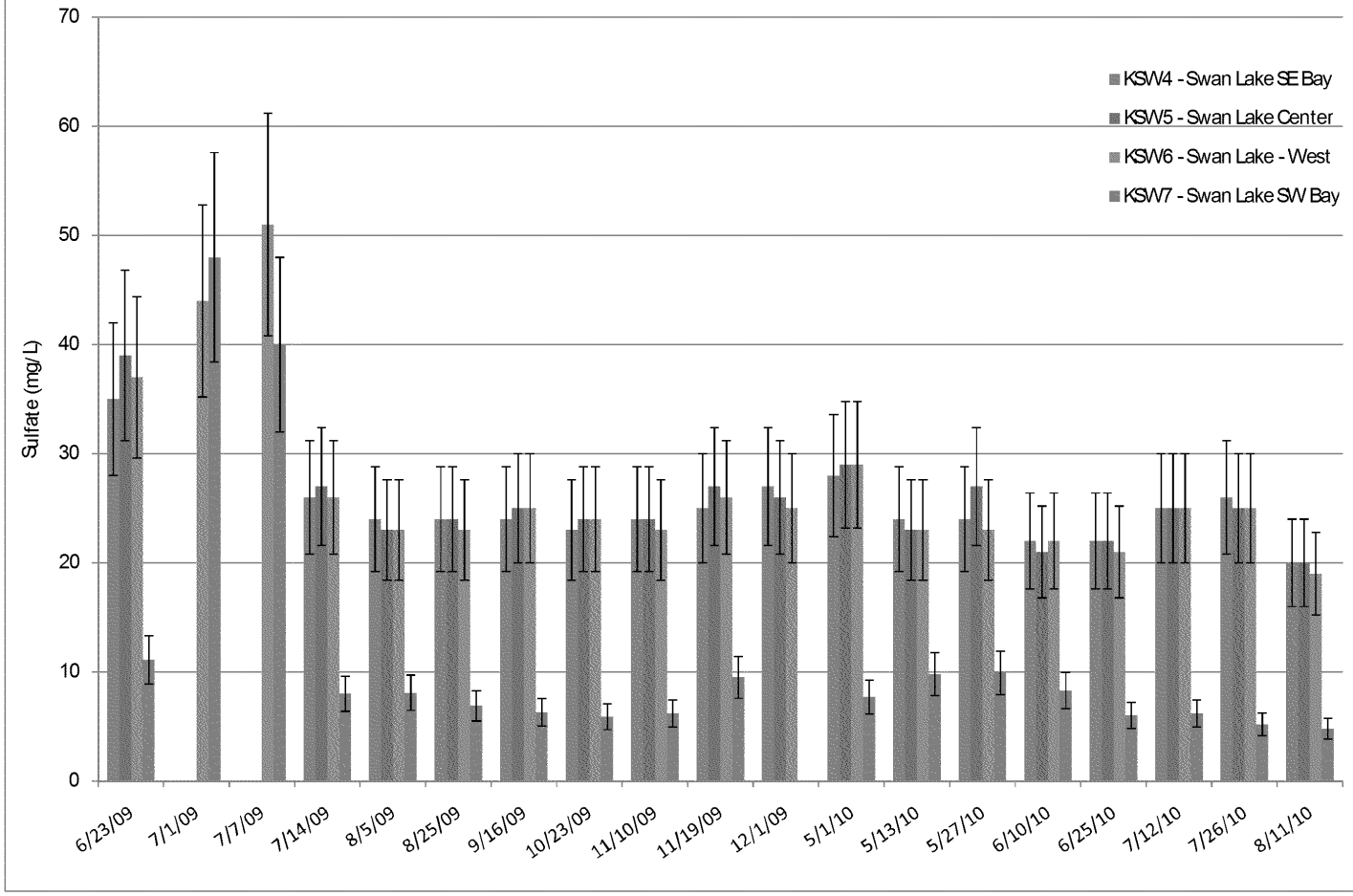
Figures

R5-2015-0101170000385

Figure 1

2010 WATER QUALITY MONITORING LOCATIONS
Essar Steel
Itasca County, Minnesota

Figure 2: Sulfate Concentrations in Swan Lake SurfaceSamples 2009-2010



Barr Footer: Date: 9/8/2010 7:37:05 AM File: I:\Client\Essar Steel\Work Orders\Essar Expansion Permitting & SEIS\Maps\Reports\Wild Rice\Figure 3 Initial Wild Rice Reconnaissance.mxd User: amm

Surface Flows

Transfer (Stream Augmentation if Necessary)

Waterbodies with Initial Observations to Determine Wild Rice Presence

Streams

Lakes

0 2,000 4,000 8,000 Feet

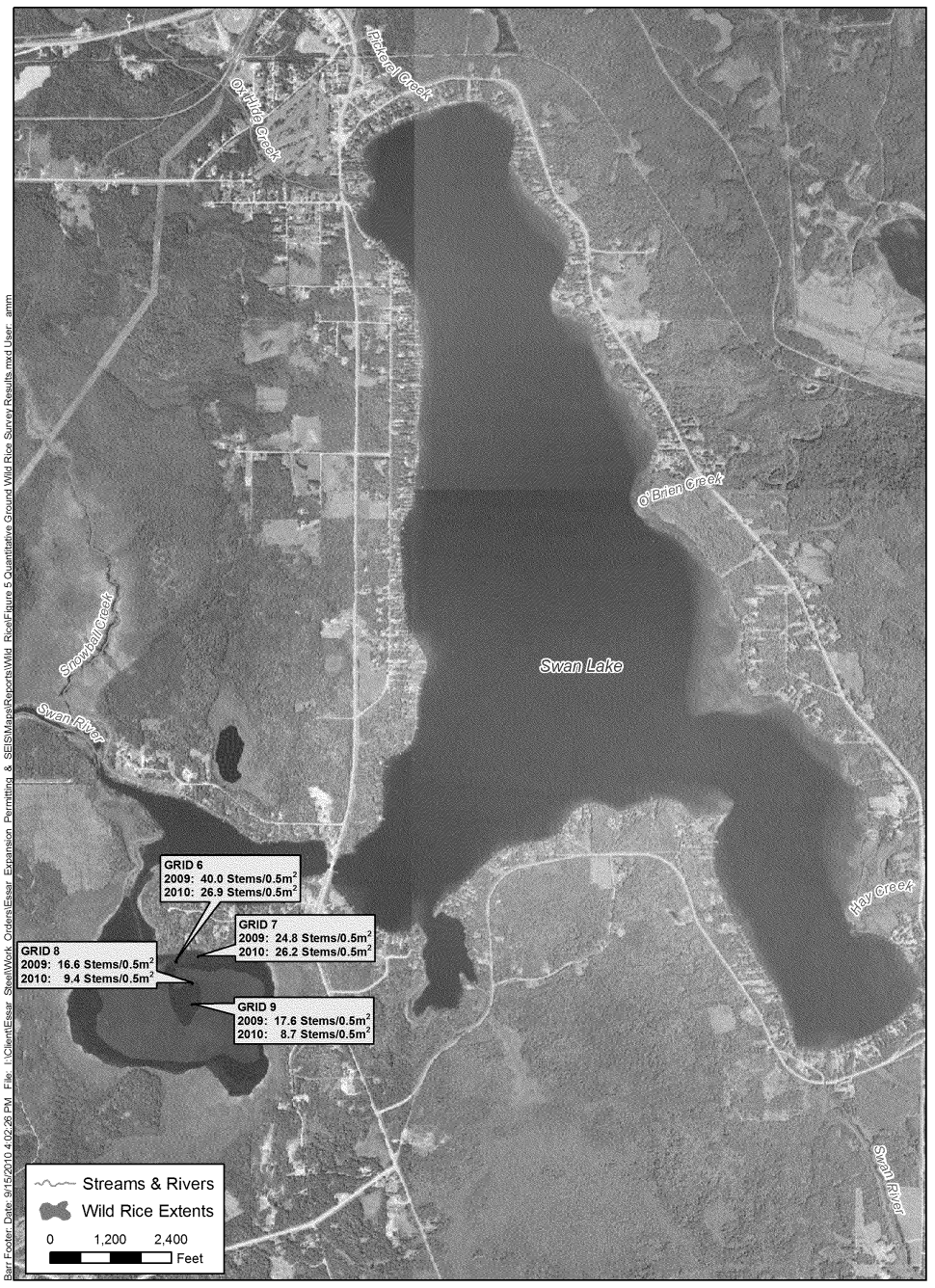
0 0.25 0.5 1 1.5 Miles

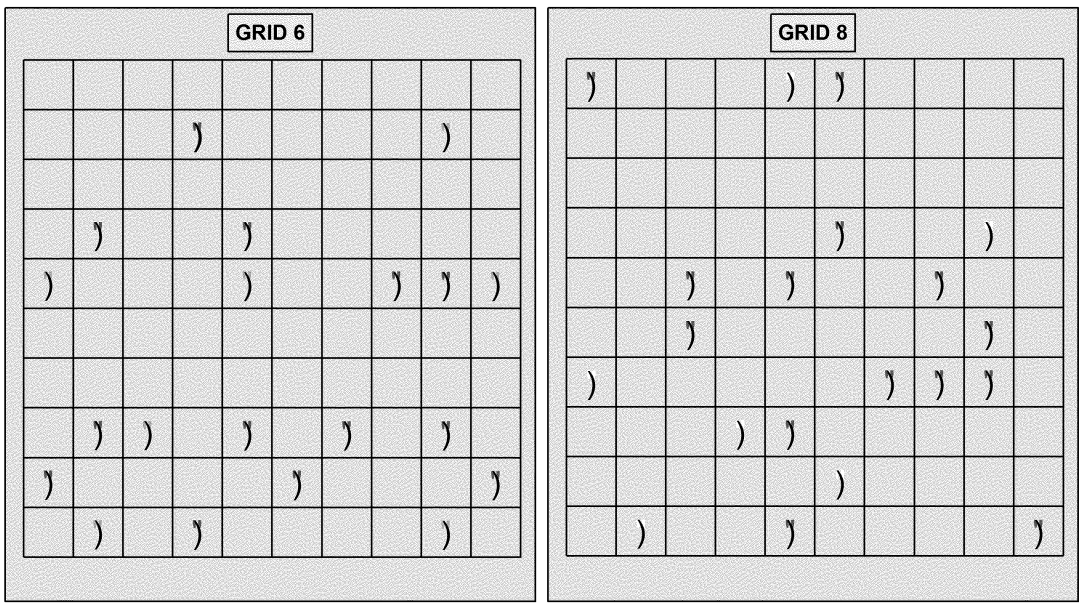
Figure 3
INITIAL WILD RICE RECONNAISSANCE,
O'BRIEN RESERVOIR, SNOWBALL LAKE,
OX HIDE LAKE, AND PICKEREL CREEK
JULY 2010
Essar Steel
Itasca County, Minnesota

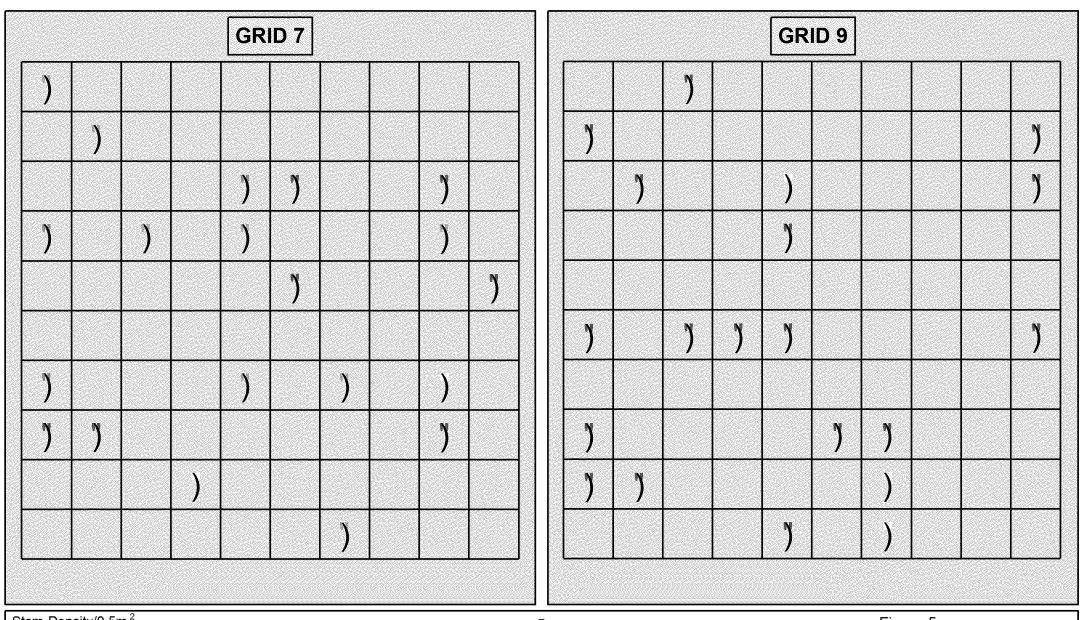
R5-2015-0101170000385

Figure 4

QUALITATIVE RESULTS OF WILD RICE SURVEYS FOR SWAN LAKE AND SWAN RIVER, AUGUST 2010
Essar Steel
Itasca County, Minnesota







Stem Density/0.5m²
0
1-25
26-50
51-75
76-100

2.5 1.25 0 2.5
Meters

Figure 5
QUANTITATIVE RESULTS OF WILD RICE SURVEYS FOR SWAN LAKE, AUGUST 2010
August 18-19, 2010
Essar Steel
Itasca County, Minnesota

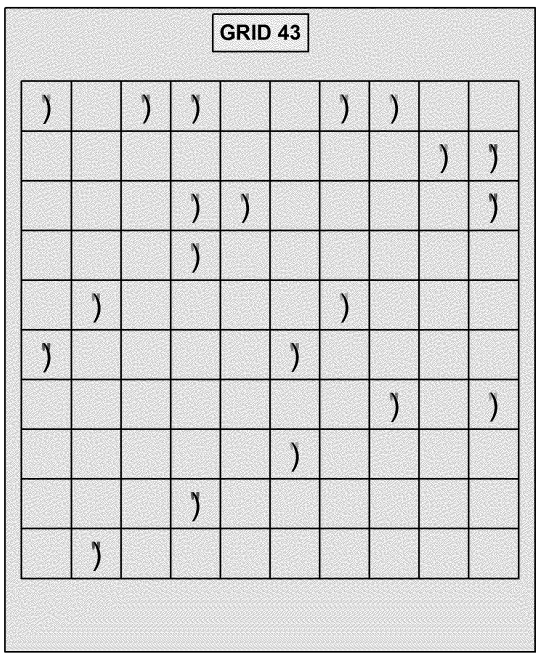


Figure 6
QUANTITATIVE RESULTS OF WILD RICE
SURVEYS FOR SWAN RIVER, SEPTEMBER 2010
Essar Steel
Itasca County, Minnesota

Streams & Rivers
10x10 Meter Grid Location

Stems Density/1.0m2

0
1-25
26-50
51-75
76-100
101-125
126-150
151-175

900 450 0 900
Feet

Appendices

Appendix A

Water Quality Monitoring Field Parameters

ES OH WQ1 - Ox Hide Lake

Sample Date	Sample Depth (m)	Temperature (□C)	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)
6/24/2010	0	20.3	0.365	10.49	8.49	64.6
7/7/2010	0	23.9	0.352	8.94	8.59	2.8
7/21/2010	0	23.3	0.349	8.58	8.55	67.2

Notes

mg/L is milligrams per Liter

□C is degrees Celcius

mS/cm is milliSiemens per centimeter

mV is milliVolts

ESSB WQ1 - Snowball Lake

Sample Date	Sample Depth (m)	Temperature (□C)	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)
6/24/2010	0	20.9	0.242	11.40	8.76	50.2
7/7/2010	0	24.7	0.237	8.33	8.93	-12.3
7/21/2010	0	23.3	0.233	8.41	8.55	57.5

Notes

mg/L is milligrams per Liter

□C is degrees Celcius

mS/cm is milliSiemens per centimeter

mV is milliVolts

ES OB WQ1 - O'Brien Lake North

Sample Date	Sample Depth (m)	Temperature (□C)	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)
6/24/2010	0	20.6	0.331	9.80	8.42	81.5
7/7/2010	0	24.0	0.323	8.38	8.55	14.4
7/21/2010	0	23.3	0.321	8.79	8.51	43.5

Notes

mg/L is milligrams per Liter

□C is degrees Celcius

mS/cm is milliSiemens per centimeter

mV is milliVolts

ES OB WQ2 - O'Brien Lake South

Sample Date	Sample Depth (m)	Temperature (□C)	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)
6/24/2010	0	21.7	0.280	10.01	8.35	127.1
7/7/2010	0	25.2	0.304	9.80	8.67	16.8
7/21/2010	0	23.2	0.302	7.60	8.30	67.2

Notes

mg/L is milligrams per Liter

□C is degrees Celcius

mS/cm is milliSiemens per centimeter

mV is milliVolts

ESPCWQ1 - Pickerel Creek North

Sample Date	Sample Depth (m)	Temperature (□C)	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)
6/24/2010	0	18.1	1.036	9.75	8.17	61.4
7/7/2010	0	21.3	0.914	6.85	8.14	-3.6
7/21/2010	0	19.6	0.723	6.56	8.22	8.2

Notes

mg/L is milligrams per Liter

□C is degrees Celcius

mS/cm is milliSiemens per centimeter

mV is milliVolts

ESPCWQ2 - Pickerel Creek South

Sample Date	Sample Depth (m)	Temperature (□C)	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)
6/24/2010	0	16.3	0.927	10.74	8.34	66.6
7/7/2010	0	18.5	0.789	8.20	8.14	-10.5
7/21/2010	0	15.4	0.723	7.77	8.05	31.5

Notes

mg/L is milligrams per Liter

□C is degrees Celcius

mS/cm is milliSiemens per centimeter

mV is milliVolts

KSW4 - Swan Lake (Southeast)

Sample Date	Sample Depth (m)	Secchi Depth (m)	Temperature (□C)	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)
6/24/2009	0	4.0	23.9	0.341	9.45	8.89	-7.8
	1		23.5	0.342	9.91	8.96	-8.6
	2		22.5	0.341	9.78	9.04	-10.8
	3		22.0	0.341	9.96	9.01	-11.4
	4		20.3	0.338	9.79	8.92	-9.5
	5		16.6	0.339	10.75	8.69	-2.7
	6		14.1	0.341	8.66	8.30	6.1
	7		13.5	0.342	8.20	8.21	8.9
	8		13.0	0.342	8.03	8.23	9.1
	8.5		12.9	0.342	7.74	8.19	9.5
7/15/2009	0	4.5	18.9	0.344	8.07	8.31	-14.7
	1		18.9	0.344	8.00	8.32	-12.7
	2		18.8	0.344	7.92	8.31	-9.6
	3		18.8	0.344	7.95	8.29	-6.7
	4		18.7	0.344	7.84	8.25	-3.6
	5		18.6	0.344	7.81	8.21	-1.1
	6		18.6	0.344	7.71	8.19	-0.7
	7		18.4	0.344	7.59	8.17	0.1
	8		18.0	0.345	7.28	8.13	2.8
	8.5		17.3	0.343	6.55	7.92	6.4
8/5/2009	0	2.7	19.4	0.345	9.11	8.91	-26.5
	1		19.4	0.346	8.89	8.84	-19.5
	2		19.4	0.346	9.00	8.79	-15.1
	3		19.3	0.346	8.74	8.76	-12.8
	4		19.2	0.346	8.75	8.74	-9.3
	5		19.2	0.346	8.78	8.73	-7.5
	6		19.1	0.346	8.77	8.63	-5.4
	7		19.0	0.346	8.60	8.62	-2.2
	8		18.8	0.345	8.36	8.54	-0.5
	8.5		18.7	0.345	8.34	8.50	0.2

KSW4 - Swan Lake (Southeast)

Sample Date	Sample Depth (m)	Secchi Depth (m)	Temperature (□C)	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)
8/25/2009	0	2.9	20.2	0.342	8.05	--	-101.6
	1		20.1	0.342	8.00	--	-102.0
	2		20.1	0.343	8.08	--	-102.1
	3		20.0	0.343	8.06	--	-101.1
	4		19.9	0.343	8.05	--	-100.9
	5		19.9	0.344	8.02	--	-105.5
	6		19.9	0.344	7.98	--	-100.0
	7		19.7	0.344	7.93	--	-101.9
	8		19.7	0.344	7.87	--	-102.8
	8.5		19.6	0.344	7.71	--	-103.1
9/15/2009	0	3.6	22.5	0.354	8.34	8.89	-101.6
	1		22.4	0.354	8.76	8.92	-102.0
	2		21.1	0.353	9.22	8.93	-102.1
	3		20.8	0.353	9.00	8.84	-101.1
	4		20.6	0.354	8.42	8.73	-100.9
	5		20.4	0.354	8.42	8.62	-105.5
	6		20.3	0.356	8.29	8.52	-100.0
	7		19.8	0.357	7.77	8.42	-101.9
	8		19.4	0.358	6.16	8.09	-102.8
	8.5		19.1	0.358	5.70	7.93	-103.1
10/23/2009	0	3.5	8.7	0.324	9.54	8.04	-31.2
	1		8.8	0.324	9.40	8.08	-31.6
	2		8.7	0.324	9.41	8.07	-30.2
	3		8.8	0.324	9.39	8.06	-31.4
	4		8.7	0.324	9.40	8.06	-32.1
	5		8.7	0.324	9.46	8.06	-29.4
	6		8.7	0.324	9.46	8.12	-28.3
	7		8.7	0.325	9.47	8.14	-28.7
	8		8.7	0.325	9.48	8.08	-28.5
	8.5		8.7	0.326	9.48	8.06	-29.4

KSW4 - Swan Lake (Southeast)

Sample Date	Sample Depth (m)	Secchi Depth (m)	Temperature (□C)	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)
11/10/2009	0	--	6.2	0.349	10.02	7.51	124.5
	1		6.3	0.349	10.06	7.45	123.1
	2		6.2	0.349	10.08	7.43	119.8
	3		6.2	0.357	10.09	7.40	119.6
	4		6.2	0.357	10.04	7.41	115.4
	5		6.2	0.357	10.08	7.36	114.7
	6		6.1	0.357	10.02	7.31	114.8
	7		6.1	0.357	9.92	7.40	110.8
	8		6.1	0.357	9.97	7.31	109.7
	8.5		6.0	0.357	9.88	7.31	107.0
11/19/2009	0	--	5.3	0.353	10.93	7.66	116.5
	1		5.3	0.354	11.00	7.88	106.1
	2		5.2	0.354	10.67	7.99	101.2
	3		5.1	0.355	10.80	8.03	99.2
	4		5.1	0.364	10.86	8.05	98.6
	5		5.1	0.364	11.00	8.06	98.6
	6		5.1	0.364	10.96	8.01	98.9
	7		5.0	0.364	11.06	8.10	98.1
	8		5.0	0.364	10.92	8.16	98.1
	8.5		5.0	0.364	11.03	8.07	95.7
12/1/2009	0	--	3.3	0.339	11.79	8.70	96.0
	1		3.3	0.339	11.69	8.52	103.9
	2		3.3	0.339	11.70	8.43	106.8
	3		3.3	0.339	11.68	8.35	111.5
	4		3.3	0.339	11.69	8.41	112.9
	5		3.3	0.339	11.69	8.15	116.4
	6		3.3	0.339	11.67	8.35	116.8
	7		3.3	0.339	11.68	8.22	119.6
	8		3.3	0.339	11.70	8.06	122.0
	8.5		3.4	0.340	11.62	8.19	121.1

KSW4 - Swan Lake (Southeast)

Sample Date	Sample Depth (m)	Secchi Depth (m)	Temperature (°C)	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)
5/13/2010	0	--	9.5	0.368	9.95	8.26	192.4
5/27/2010	0	--	21.3	0.375	10.37	8.53	16.5
6/10/2010	0	--	17.2	0.358	9.30	8.85	5.2
6/25/2010	0	2.4	21.0	0.355	9.02	8.64	-69.7
7/12/2010	0	2.9	25.3	0.346	8.06	9.14	-51.5
7/26/2010	0	2.7	23.8	0.342	8.86	8.83	-48.5
8/11/2010	0	2.4	24.6	0.340	8.18	8.98	-48.2

Notes

mg/L is milligrams per Liter

°C is degrees Celcius

mS/cm is milliSiemens per centimeter

mV is milliVolts

KSW5 - Swan Lake (Center)

Sample Date	Sample Depth (m)	Secchi Depth (m)	Temperature (□C)	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)
6/24/2009	0	5.0	23.4	0.344	9.47	9.17	-8.0
	1		22.8	0.343	9.37	9.08	-12.7
	2		21.3	0.342	9.79	8.97	-15.1
	3		20.6	0.341	10.17	8.93	-16.7
	4		20.0	0.340	10.12	8.92	-17.8
	5		16.8	0.338	10.65	8.74	-13.3
	6		14.3	0.341	10.05	8.49	-7.2
	7		13.4	0.341	8.80	8.26	-2.1
	8		13.2	0.341	8.93	8.33	-3.1
	9		13.0	0.340	9.27	8.33	-3.5
	10		12.8	0.341	9.05	8.30	-3.5
	11		12.7	0.341	8.52	8.28	-3.2
	12		12.6	0.342	7.40	8.22	-1.2
	13		12.4	0.342	6.81	8.16	-0.1
	14		12.3	0.343	6.34	8.10	1.5
	15		12.2	0.342	6.30	8.10	0.7
	16		11.8	0.344	2.96	7.99	3.4
	17		11.6	0.347	1.20	7.95	3.3
	17.5		11.5	0.348	1.13	7.96	2.4
	18		11.5	0.349	0.90	8.03	-1.6
7/15/2009	0	4.6	19.4	0.344	8.33	8.37	148.2
	1		19.4	0.344	8.35	8.34	141.1
	2		19.4	0.344	8.32	8.32	137.0
	3		19.4	0.344	8.37	8.33	127.1
	4		19.4	0.344	8.39	8.35	120.3
	5		19.4	0.344	8.39	8.30	115.7
	6		19.4	0.344	8.40	8.31	113.2
	7		19.4	0.344	8.32	8.23	107.3
	8		19.1	0.344	8.09	8.22	106.5
	9		18.2	0.345	7.67	8.19	106.2
	10		18.0	0.345	7.61	8.22	104.4
	11		14.7	0.346	4.29	7.51	110.0
	12		13.8	0.345	3.45	7.42	111.9
	13		12.8	0.345	2.31	7.36	111.9
	14		12.1	0.347	0.53	7.26	113.7
	15		12.0	0.348	0.18	7.23	111.8
	16		12.0	0.348	0.15	7.28	110.6
	17		11.9	0.350	0.13	7.39	98.2
	18		11.9	0.351	0.12	7.36	-112.6

KSW5 - Swan Lake (Center)

Sample Date	Sample Depth (m)	Secchi Depth (m)	Temperature (□C)	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)
8/5/2009	0	4.0	18.9	0.343	8.69	8.16	28.7
	1		18.9	0.343	8.60	8.14	27.2
	2		18.8	0.344	8.73	8.15	25.5
	3		18.8	0.345	8.69	8.14	24.8
	4		18.8	0.345	8.61	8.16	23.9
	5		18.8	0.345	8.50	8.26	22.5
	6		18.8	0.345	8.62	8.18	22.5
	7		18.8	0.345	8.62	8.20	21.5
	8		18.6	0.346	8.37	8.24	21.2
	9		18.6	0.346	8.32	8.10	23.8
	10		17.8	0.347	6.58	7.85	26.9
	11		16.4	0.347	4.03	7.63	32.3
	12		14.9	0.348	2.07	7.46	35.8
	13		13.5	0.348	0.66	7.36	35.3
	14		12.9	0.350	0.25	7.20	37.1
	15		12.7	0.351	0.16	7.12	39.4
	16		12.5	0.345	0.14	6.98	43.2
	17		12.2	0.357	0.13	6.96	44.4
	18		12.1	0.358	0.13	6.88	47.6
8/25/2009	0	3.1	20.4	0.342	8.22	--	-111.6
	1		20.3	0.342	8.29	--	-109.5
	2		20.3	0.342	8.33	--	-108.8
	3		20.2	0.342	8.29	--	-109.1
	4		20.1	0.342	8.29	--	-106.2
	5		19.9	0.342	8.24	--	-80.4
	6		19.8	0.342	8.00	--	-83.0
	7		19.8	0.343	7.87	--	-82.2
	8		19.7	0.343	7.89	--	-80.3
	9		19.7	0.343	7.84	--	-84.2
	10		18.7	0.345	6.00	--	-86.1
	11		18.7	0.346	5.50	--	-88.5
	12		15.9	0.346	1.06	--	-92.0
	13		14.2	0.349	0.15	--	-105.1
	14		13.3	0.353	0.15	--	-109.2
	15		12.8	0.356	0.14	--	-122.2
	16		12.7	0.358	0.13	--	-129.3
	17		12.6	0.359	0.13	--	-131.2
	18		12.6	0.359	0.12	--	-141.2

KSW5 - Swan Lake (Center)

Sample Date	Sample Depth (m)	Secchi Depth (m)	Temperature (□C)	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)
9/15/2009	0	3.8	22.2	0.352	8.20	8.84	80.3
	1		22.2	0.353	9.37	8.85	74.5
	2		22.0	0.352	9.24	8.86	73.1
	3		21.4	0.352	9.18	8.82	74.6
	4		20.7	0.353	9.09	8.64	81.9
	5		20.5	0.354	8.62	8.38	93.6
	6		20.0	0.356	8.02	8.21	98.6
	7		19.7	0.357	7.22	7.96	110.2
	8		19.2	0.357	5.78	7.64	121.3
	9		18.7	0.358	4.76	7.47	124.5
	10		17.8	0.359	2.23	6.93	141.9
	11		17.4	0.359	1.45	6.76	148.9
	12		16.6	0.359	0.16	6.58	155.8
	13		15.5	0.362	0.11	6.50	168.9
	14		14.2	0.367	0.11	6.33	156.9
	15		13.9	0.369	0.11	6.25	148.2
	16		13.0	0.376	0.11	6.35	118.6
	17		12.8	0.379	0.11	6.30	104.0
	18		12.7	0.392	0.11	6.26	91.6
10/23/2009	0	3.4	9.1	0.324	8.99	8.24	-40.1
	1		9.1	0.324	8.99	8.23	-40.0
	2		9.1	0.324	8.98	8.21	-38.9
	3		9.1	0.324	9.04	8.13	-35.6
	4		9.1	0.324	9.02	8.12	-35.9
	5		9.1	0.324	9.04	8.10	-35.5
	6		9.1	0.324	9.09	8.11	-34.5
	7		9.1	0.324	9.07	8.28	-35.1
	8		9.1	0.324	9.10	8.29	-34.5
	9		9.1	0.324	9.13	8.25	-33.6
	10		9.1	0.324	9.13	8.22	-33.4
	11		9.1	0.324	9.13	8.21	-33.5
	12		9.1	0.324	9.15	7.82	-32.0
	13		9.1	0.324	9.14	7.84	-32.5
	14		9.1	0.324	9.21	7.82	-25.6
	15		9.1	0.324	9.15	7.88	-26.3
	16		8.7	0.324	9.27	7.71	-25.9
	17		8.7	0.324	9.21	7.69	-23.6
	18		8.9	0.331	8.46	7.70	-21.8

KSW5 - Swan Lake (Center)

Sample Date	Sample Depth (m)	Secchi Depth (m)	Temperature (□C)	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)
11/10/2009	0	--	6.7	0.356	9.71	7.96	69.9
	1		6.8	0.356	9.79	7.93	70.0
	2		6.7	0.356	9.70	7.99	66.0
	3		6.6	0.356	9.67	7.91	68.5
	4		6.5	0.356	9.64	7.88	71.3
	5		6.5	0.356	9.67	7.85	72.2
	6		6.5	0.356	9.60	7.76	74.7
	7		6.5	0.356	9.64	7.78	76.5
	8		6.4	0.356	9.60	7.74	77.4
	9		6.4	0.356	9.64	7.77	78.1
	10		6.4	0.356	9.59	7.7	78.6
	11		6.4	0.356	9.61	7.63	80.9
	12		6.4	0.356	9.59	7.87	66.4
	13		6.4	0.356	9.60	7.81	67.2
	14		6.4	0.356	9.62	7.8	67.9
	15		6.4	0.356	9.56	7.75	69.5
	16		6.4	0.356	9.60	7.71	70.4
	17		6.4	0.356	9.54	7.71	70.0
	18		6.4	0.356	9.00	7.63	73.0
11/19/2009	0	--	5.8	0.361	10.53	8.05	144.3
	1		5.8	0.361	10.42	8.03	142.4
	2		5.8	0.361	10.43	7.98	142.1
	3		5.7	0.361	10.46	7.95	141.2
	4		5.7	0.361	10.53	7.89	142.4
	5		5.7	0.361	10.45	7.91	142.1
	6		5.7	0.361	10.43	7.89	140.4
	7		5.7	0.361	10.61	7.91	139.5
	8		5.7	0.361	10.40	7.92	138.0
	9		5.7	0.361	10.58	7.63	139.3
	10		5.7	0.361	10.36	7.81	136.2
	11		5.7	0.361	10.53	7.75	135.4
	12		5.7	0.361	10.55	7.69	135.5
	13		5.7	0.361	10.67	7.69	134.7
	14		5.7	0.361	10.63	7.66	134.3
	15		5.7	0.361	10.46	7.6	134.2
	16		5.7	0.361	10.48	7.65	137.6
	17		5.7	0.361	10.57	7.63	131.9
	18		5.7	0.361	10.61	7.66	132.0

KSW5 - Swan Lake (Center)

Sample Date	Sample Depth (m)	Secchi Depth (m)	Temperature (□C)	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)
12/1/2009	0	--	4.3	0.336	11.06	8.56	136.7
	1		4.4	0.336	11.18	8.39	140.0
	2		4.3	0.336	11.07	8.3	138.5
	3		4.4	0.336	11.04	8.28	140.0
	4		4.4	0.336	11.11	8.2	141.2
	5		4.4	0.336	11.09	8.18	141.6
	6		4.4	0.336	11.11	8.25	141.9
	7		4.4	0.336	11.09	8.08	144.0
	8		4.4	0.336	11.09	7.95	144.6
	9		4.4	0.336	11.09	8.04	143.3
	10		4.4	0.336	11.09	8.03	142.4
	11		4.4	0.336	11.05	7.98	141.8
	12		4.4	0.336	11.07	8.08	142.0
	13		4.4	0.335	11.10	7.96	141.7
	14		4.3	0.336	11.11	8.14	139.0
	15		4.3	0.336	11.11	8.02	139.7
	16		4.3	0.335	11.11	8.13	139.0
	17		4.3	0.335	11.09	8.03	138.8
	18		4.3	0.335	11.07	8.02	138.3
5/13/2010	0	--	9.6	0.370	9.87	8.33	188.2
	2		9.6	0.370	9.90	8.32	188.3
	4		9.6	0.370	10.02	8.30	188.8
	6		9.6	0.370	9.93	8.18	189.5
	8		9.6	0.370	9.90	8.20	189.9
	10		9.6	0.370	9.91	8.14	190.3
	12		9.5	0.370	9.90	8.28	190.4
	14		9.5	0.370	9.93	8.22	191.6
	16		9.5	0.370	9.94	8.24	191.8
	18		9.5	0.370	9.81	8.25	192.8

KSW5 - Swan Lake (Center)

Sample Date	Sample Depth (m)	Secchi Depth (m)	Temperature (□C)	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)
5/13/2010	0	--	9.6	0.370	9.87	8.33	188.2
	2		9.6	0.370	9.90	8.32	188.3
	4		9.6	0.370	10.02	8.30	188.8
	6		9.6	0.370	9.93	8.18	189.5
	8		9.6	0.370	9.90	8.20	189.9
	10		9.6	0.370	9.91	8.14	190.3
	12		9.5	0.370	9.90	8.28	190.4
	14		9.5	0.370	9.93	8.22	191.6
	16		9.5	0.370	9.94	8.24	191.8
	18		9.5	0.370	9.81	8.25	192.8
5/27/2010	0	--	18.9	0.374	9.98	8.52	6.6
	2		17.0	0.372	10.58	8.49	8.2
	4		16.2	0.371	10.65	8.54	12.6
	6		14.2	0.371	10.80	8.56	30.9
	8		11.9	0.371	10.67	8.47	37.6
	10		10.8	0.371	10.13	8.35	42.1
	12		10.4	0.372	9.71	8.32	45.3
	14		9.9	0.372	9.14	8.22	-116.8
	16		9.6	0.373	8.82	8.18	-112.7
	18		9.6	0.373	8.52	8.17	-122.7
6/10/2010	0	2.3	17.4	0.360	9.27	8.70	25.0
	2		17.4	0.359	9.00	8.75	23.6
	4		17.4	0.359	9.27	8.73	22.5
	6		17.4	0.359	9.06	8.73	21.4
	8		13.3	0.362	8.30	8.43	32.3
	10		11.5	0.362	8.24	8.21	39.0
	12		10.5	0.362	7.71	8.07	44.2
	14		10.1	0.362	7.82	8.04	46.7
	16		9.6	0.364	5.35	7.90	49.5
	18		9.6	0.364	5.08	7.81	52.2

KSW5 - Swan Lake (Center)

Sample Date	Sample Depth (m)	Secchi Depth (m)	Temperature (°C)	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)
6/25/2010	0	3.1	21.0	0.361	9.29	8.81	-41.2
	2		19.7	0.361	9.40	8.78	-39.8
	4		19.3	0.361	9.42	8.77	-39.4
	6		18.8	0.364	9.23	8.71	-37.8
	8		15.9	0.369	7.68	8.34	-25.0
	10		12.2	0.371	6.52	8.02	-14.0
	12		11.2	0.371	6.38	7.86	-9.9
	14		10.3	0.372	6.26	7.81	-9.6
	16		9.7	0.373	3.25	7.54	-5.0
	18		9.7	0.373	3.17	7.53	-5.1
7/12/2010	0	5.0	24.9	0.353	8.38	9.08	-41.8
	2		23.4	0.352	8.39	9.07	-41.1
	4		23.1	0.352	8.28	9.06	-41.0
	6		22.3	0.354	7.44	8.94	-36.4
	8		19.4	0.359	5.17	8.58	-19.2
	10		14.3	0.364	3.84	8.25	-6.6
	12		11.8	0.364	3.57	8.17	-3.1
	14		10.6	0.364	3.13	8.04	1.2
	16		10.0	0.365	0.40	7.96	2.9
	18		9.9	0.369	0.28	8.37	-37.5
8/11/2010	0	3.5	25.6	0.341	8.78	9.02	-53.0
	2		25.5	0.341	8.80	9.04	-53.2
	4		23.5	0.341	8.22	8.96	-50.0
	6		23.0	0.344	7.07	8.84	-45.6
	8		22.0	0.348	5.04	8.61	-36.9
	10		21.6	0.349	0.09	8.32	-27.2
	12		12.3	0.359	0.80	7.95	-11.3
	14		10.7	0.361	0.12	7.87	-8.2
	16		10.2	0.370	0.13	7.85	-7.5
	18		10.1	0.373	0.13	8.50	-47.6

Notes

mg/L is milligrams per Liter

°C is degrees Celcius

mS/cm is milliSiemens per centimeter

mV is milliVolts

KSW6 - Swan Lake (West)

Sample Date	Sample Depth (m)	Secchi Depth (m)	Temperature (°C)	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)
6/24/2009	0	4.0	24.5	0.319	8.93	8.87	-1.1
7/1/2009	0	2.6	17.9	0.335	8.79	8.21	1.5
7/6/2009	0	3.7	20.0	0.339	8.55	9.39	-12
7/15/2009	0	3.5	20.1	0.339	7.42	8.27	21.8
8/5/2009	0	3.2	19.5	0.338	9.26	9.18	-7.5
8/25/2009	0	3.2	21.1	0.334	8.59	--	-90.1
9/16/2009	0	3.1	22.5	0.346	8.86	8.97	49.8
10/23/2009	0	3.5	6.2	0.309	10.69	7.91	10.4
11/10/2009	0	--	5.5	0.339	11.7	7.64	185.1
11/19/2009	0	--	4.9	0.354	12.4	8.22	102.7
12/1/2009	0	--	2.7	0.326	12.98	8.29	88.8
5/13/2010	0	--	10.4	0.354	10.45	8.54	190.5
5/27/2010	0	--	21.5	0.356	10.15	8.7	8.8
6/10/2010	0	--	17.5	0.349	8.99	8.91	-2.8
6/25/2010	0	2.3	21.1	0.344	9.31	8.73	-70.1
7/12/2010	0	2.6	25.4	0.351	8.55	9.23	-53.1
7/26/2010	0	2.3	25.5	0.342	9.62	8.94	-49.4
8/11/2010	0	1.4	25.9	0.329	10.44	9.19	-53.9

Notes

mg/L is milligrams per Liter

°C is degrees Celcius

mS/cm is milliSiemens per centimeter

mV is milliVolts

KSW7 - Swan Lake (Southwest Bay)

Sample Date	Sample Depth (m)	Temperature (□C)	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)
6/24/2009	0	27.4	0.189	8.55	8.84	17.8
	0.8	27.4	0.188	7.72	8.85	16.1
7/1/2009	0	15.5	0.185	11.00	7.97	23.2
	0.8	15.5	0.185	10.88	8.01	19.0
7/6/2009	0	24.0	0.189	8.23	8.61	-18.4
	0.7	24.0	0.190	8.21	8.60	-23.1
7/15/2009	0	18.7	0.192	7.99	8.00	4.0
	0.7	18.7	0.193	7.98	8.00	-1.2
8/5/2009	0	19.3	0.188	10.00	9.03	-22.2
	0.7	19.3	0.188	9.82	8.91	-18.3
8/25/2009	0	22.7	0.191	8.15	--	-106.2
9/15/2009	0	23.4	0.216	7.47	8.73	91.3
10/23/2009	0	3.2	0.201	13.20	7.67	10.0
11/10/2009	0	4.8	0.208	12.38	7.82	203.9
11/19/2009	0	4.3	0.215	13.69	7.07	200.0

KSW7 - Swan Lake (Southwest Bay)

Sample Date	Sample Depth (m)	Temperature (□C)	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)
5/13/2010	0	10.5	0.195	10.05	8.35	189.9
5/27/2010	0	25.5	0.213	9.09	8.78	1.0
6/10/2010	0	15.8	0.213	9.07	8.73	-0.2
6/25/2010	0	22.2	0.194	8.14	8.46	-59.1
7/12/2010	0	27.1	0.188	7.49	8.89	-35.2
7/26/2010	0	26.9	0.184	10.33	9.11	-54.6
8/11/2010	0	27.2	0.183	8.36	8.95	-46.7

Notes

mg/L is milligrams per Liter

□C is degrees Celcius

mS/cm is milliSiemens per centimeter

mV is milliVolts

Appendix B

2009 Swan Lake Water Chemistry, U. S. Steel Corporation, KeeTac Expansion Project

U.S. Steel Corporation - KeeTac Expansion Project

Table 1: Iron and Sulfate Concentrations in Surface Water Samples, 2009.
Concentrations are in mg/L

KSW1A - Hay Creek Upstream of Hay Lake

	6/23/2009		7/1/2009		7/6/2009		7/14/2009		8/5/2009		8/25/2009		9/16/2009		10/23/2009		11/10/2009		11/19/2009		12/1/2009	
Depth (m)	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron
0	42	0.780	64	0.530	84	0.440	56	0.490	48	0.410	46	0.350	52	0.410	49	0.280	54	0.150	NS	NS	51	0.300

KSW1B - Hay Lake

	6/23/2009		7/1/2009		7/6/2009		7/14/2009		8/5/2009		8/25/2009		9/16/2009		10/23/2009		11/10/2009		11/19/2009		12/1/2009	
Depth (m)	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron
0	49	0.480	60	0.310	78	0.250	55	0.190	49	0.150	47	0.180	48	0.170	46	0.240	48	0.200	NS	NS	NS	NS

KSW2 - Moose Lake

	6/23/2009		7/1/2009		7/6/2009		7/14/2009		8/5/2009		8/25/2009		9/16/2009		10/23/2009		11/10/2009		11/19/2009		12/1/2009	
Depth (m)	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron
0	8.4	0.630	NS	NS	NS	NS	NS	NS	4.9	0.340	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

KSW3 - Hay Creek Outlet to Swan Lake

	6/23/2009		7/1/2009		7/6/2009		7/14/2009		8/5/2009		8/25/2009		9/16/2009		10/23/2009		11/10/2009		11/19/2009		12/1/2009	
Depth (m)	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron
0	46	0.650	NS	NS	NS	NS	48	0.590	41	0.320	44	0.250	40	0.300	44	0.260	47	0.190	54	0.290	48	0.290

KSW4 - Swan Lake, Southeast

	6/24/2009		7/1/2009		7/6/2009		7/15/2009		8/5/2009		8/25/2009		9/16/2009		10/23/2009		11/10/2009		11/19/2009		12/1/2009	
Depth (m)	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron
0	35	0.057	NS	NS	NS	NS	26	< 0.020	24	0.020	24	0.019 J	24	< 0.020	23	0.015 J	24	< 0.020	25	< 0.020	27	0.027
2	41	0.038	NS	NS	NS	NS	26	< 0.020	25	0.019 J	24	0.029	25	< 0.020	24	0.012 J	23	< 0.020	28	0.020	27	0.030
4	45	0.045	NS	NS	NS	NS	26	< 0.020	25	0.020	24	0.031	25	< 0.020	25	0.013 J	23	< 0.020	27	< 0.020	28	0.050
6	44	0.022	NS	NS	NS	NS	27	< 0.020	25	0.020	25	0.019 J	26	< 0.020	24	0.012 J	23	0.023	27	0.022	27	0.028
8	39	0.017 J	NS	NS	NS	NS	26	< 0.020	25	0.020	24	0.019 J	25	< 0.020	24	0.030	23	< 0.020	28	0.021	28	0.029
8.5	40	0.016 J	NS	NS	NS	NS	26	< 0.020	25	0.023	24	0.021	25	< 0.020	24	0.014 J	24	< 0.020	27	0.021	27	0.048

KSW5 - Swan Lake, Center

	6/24/2009		7/1/2009		7/6/2009		7/15/2009		8/5/2009		8/25/2009		9/16/2009		10/23/2009		11/10/2009		11/19/2009		12/1/2009	
Depth (m)	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron
0	39	0.021	NS	NS	NS	NS	27	0.065	23	0.012 J	24	0.069	25	< 0.020	24	0.013 J	24	< 0.020	27	< 0.020	26	< 0.020
2	40	0.027	NS	NS	NS	NS	27	0.020	24	0.008 J	24	0.026	25	< 0.020	24	0.011 J	23	< 0.020	27	< 0.020	26	0.035
4	41	0.024	NS	NS	NS	NS	26	< 0.020	24	0.010 J	24	0.017 J	25	< 0.020	24	0.016 J	23	< 0.020	26	< 0.020	26	< 0.020
6	42	0.029	NS	NS	NS	NS	27	< 0.020	24	0.018 J	24	0.015 J	25	< 0.020	24	0.010 J	23	< 0.020	27	< 0.020	26	< 0.020
8	46	0.025	NS	NS	NS	NS	26	< 0.020	24	0.011 J	24	0.021	25	< 0.020	24	0.012 J	23	< 0.020	27	< 0.020	26	0.024
10	49	0.014 J	NS	NS	NS	NS	26	< 0.020	24	0.015 J	24	0.014 J	25	< 0.020	24	0.012 J	24	< 0.020	28	< 0.020	27	0.025
12	51	0.018 J	NS	NS	NS	NS	26	0.022	24	0.020	24	0.090	24	< 0.020	24	0.010 J	24	< 0.020	26	< 0.020	27	< 0.020
14	75	0.020	NS	NS	NS	NS	26	0.022	23	0.011 J	23	0.057	23	0.039	24	0.010 J	23	< 0.020	27	0.033	26	< 0.020
16	39	0.029	NS	NS	NS	NS	26	0.028	23	0.022	22	0.050	22	0.028	25	0.016 J	25	< 0.020	28	< 0.020	26	< 0.020
18	39	0.071	NS	NS	NS	NS	25	0.043	22	0.019 J	22	0.047	21	0.034	24	0.067	24	< 0.020	27	< 0.020	26	< 0.020

KSW6 - Swan Lake, West

	6/24/2009		7/1/2009		7/6/2009		7/15/2009		8/5/2009		8/25/2009		9/16/2009		10/23/2009		11/10/2009		11/19/2009		12/1/2009	
Depth (m)	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron
0	37	0.034	44	0.035	51	0.025	26	0.050	23	0.020	23	0.016 J	25	0.020	24	0.018 J	23	0.023	26	< 0.020	25	0.022

U.S. Steel Corporation - KeeTac Expansion Project

Table 1: Iron and Sulfate Concentrations in Surface Water Samples, 2009.
Concentrations are in mg/L

KSW7 - Swan Lake, Southwest																				
	6/24/2009		7/1/2009		7/6/2009		7/15/2009		8/5/2009		8/25/2009		9/16/2009		10/23/2009		11/10/2009		11/19/2009		12/1/2009	
Depth (m)	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron
0	*11.1*	*0.102*	48	0.080	40	0.380	8.0	0.086	*8.1*	*0.065*	6.9	0.094	6.3	0.069	5.9	0.044	6.2	0.048	9.5	0.034	NS	NS
0.7	12	0.140	32	0.077	45	0.089	8.0	0.086	8.0	0.068	6.9	0.079	6.2	0.065	5.8	0.039	6.2	0.045	9.0	0.034	NS	NS

KSW8 - Hart Creek																						
	6/23/2009		7/1/2009		7/6/2009		7/14/2009		8/5/2009		8/25/2009		9/16/2009		10/23/2009		11/10/2009		11/19/2009		12/1/2009	
Depth (m)	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron
0	2.8	0.820	NS	NS	NS	NS	NS	NS	1.5	3.90	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Oxhide Creek & Lake																						
	6/23/2009		7/1/2009		7/6/2009		7/14/2009		8/5/2009		8/25/2009		9/16/2009		10/23/2009		11/10/2009		11/19/2009		12/1/2009	
Depth (m)	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron	Sulfate	Iron
Creek	NS	NS	NS	NS	NS	NS	NS	NS	28	0.150	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Lake	NS	NS	NS	NS	NS	NS	NS	NS	29	0.017	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Notes

Concentrations of Iron and Sulfate are in mg/L.
Sulfate results are for ion chromatography method only.
11.1 Value is an average of six surface samples collected from various locations in Swan Lake Southwest Bay.
J Detected but below the Method Reporting Limit; therefore, result is an estimated concentration (CLP J-Flag).
NS Not sampled.

U.S. Steel Corporation - KeeTac Expansion Project
Table 2: Calcium and Magnesium Concentrations in Su rface Water Samples, 2009.

	Calcium (mg/L)	Magnesium (mg/L)	Hardness* (mg/L CaCO3)
KSW1A			
6/23/2009	27	24	166
7/1/2009	32	33	216
7/6/2009	NA	NA	NA
7/14/2009	29	33	208
8/5/2009	NA	NA	NA
8/25/2009	36	32	222
9/16/2009	34	37	237
10/23/2009	36	34	230
11/10/2009	37	38	249
11/19/2009	NS	NS	NS
12/1/2009	40	35	244
KSW1B			
6/23/2009	31	26	184
7/1/2009	31	30	201
7/6/2009	NA	NA	NA
7/14/2009	30	32	207
8/5/2009	NA	NA	NA
8/25/2009	35	33	223
9/16/2009	35	35	232
10/23/2009	37	34	232
11/10/2009	36	34	230
11/19/2009	NS	NS	NS
12/1/2009	NS	NS	NS

U.S. Steel Corporation - KeeTac Expansion Project
Table 2: Calcium and Magnesium Concentrations in Su rface Water Samples, 2009.

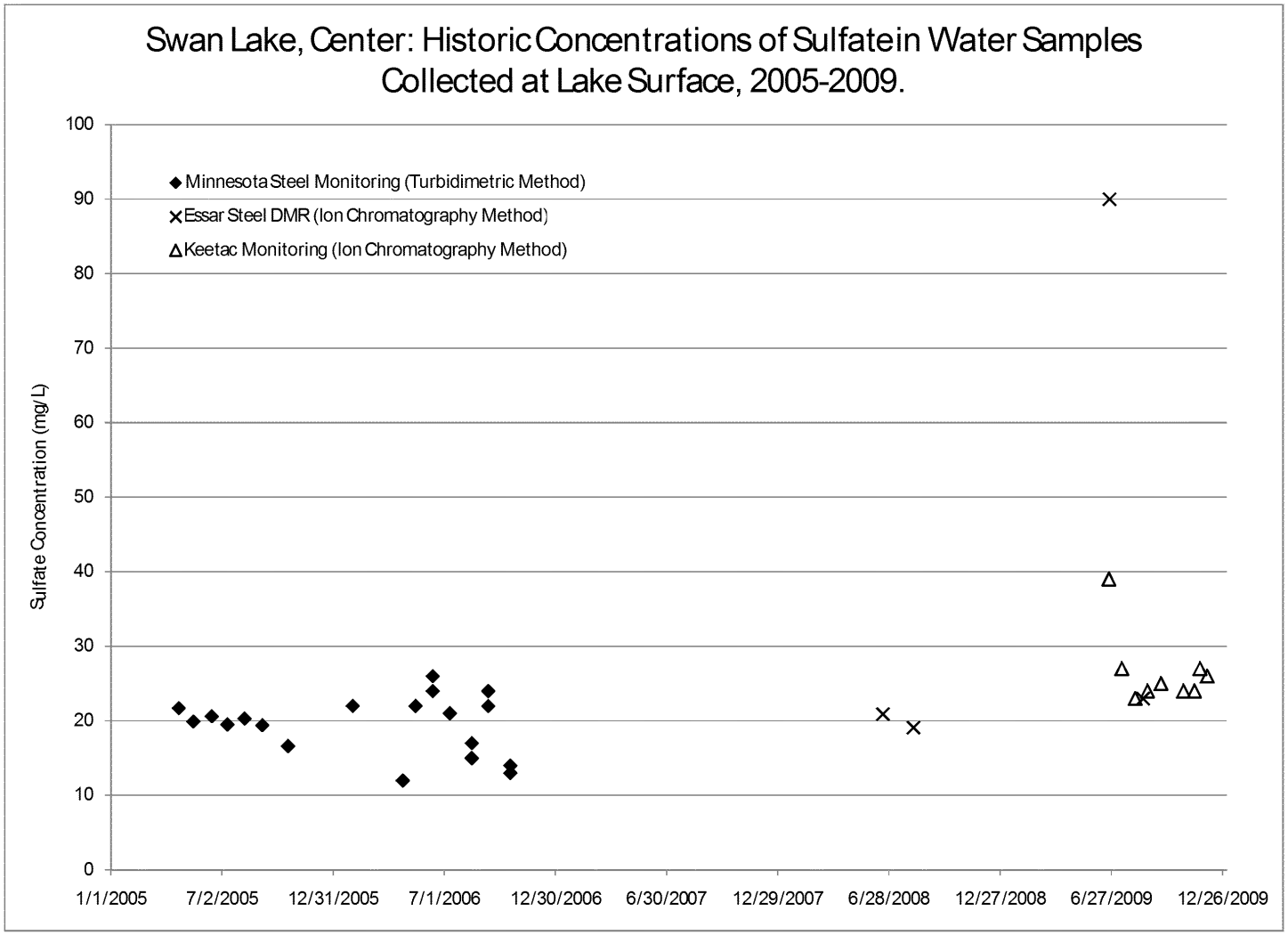
	Calcium (mg/L)	Magnesium (mg/L)	Hardness* (mg/L CaCO3)
KSW5			
6/24/2009	31	20	160
7/15/2009	31	20	160
8/5/2009	NA	NA	NA
8/25/2009	31	20	160
9/16/2009	32	21	166
10/23/2009	32	21	166
11/10/2009	32	21	166
11/19/2009	32	21	166
12/1/2009	32	21	166
KSW7			
6/24/2009	18	9.2	83
7/1/2009	19	9.3	86
7/6/2009	NA	NA	NA
7/15/2009	20	9.9	91
8/5/2009	NA	NA	NA
8/25/2009	20	9.7	90
9/16/2009	22	10	96
10/23/2009	23	11	103
11/10/2009	23	10	99
11/19/2009	22	9.9	96
12/1/2009	NS	NS	NS

Notes

NA Not Analyzed
NS Not Sampled
* Hardness was calculated by summing the concentrations of calcium and magnesium; expressed in mg/L calcium carbonate

Appendix C

Swan Lake, Center: Historic Concentrations of Sulfate in Water Samples Collected at Lake Surface, 2005-2009


Swan Lake, Center: Historic Concentrations of Sulfate in Water Samples Collected at Lake Surface, 2005-2009.
Minnesota Steel Monitoring (Turbidimetric Method)
Essar Steel DMR (Ion Chromatography Method)
Keetac Monitoring (Ion Chromatography Method)
Sulfate Concentration (mg/L)
100
90
80
70
60
50
40
30
20
10
0
1/1/2005
7/2/2005
12/31/2005
7/1/2006
12/30/2006
6/30/2007
12/29/2007
6/28/2008
12/27/2008
6/27/2009
12/26/2009

Appendix D

2010 Wild Rice Management Workgroup
"350 Significant Wild Rice Waters in Minnesota"
(updated on May 4, 2010)

R5-2015-0101170000385

350 Significant Wild Rice Waters in Minnesota

This is a list of 350 of the most important wild rice waters in Minnesota based on harvest, ecological, and/or cultural and historical values.
Please note that all waters supporting wild rice are important, and a complete inventory of these waters in Minnesota is also maintained. The complete list of wild rice waters should be consulted when appropriate (considerations for zoning, surface water use, water quality and quantity, etc.).
This list was compiled by the Wild Rice Management Workgroup, a coalition of federal, state, and tribal resource managers and other wild rice stakeholders. This list may be updated in the future as needed by the Workgroup.
list updated 5/4/2010

County	Basin Name	Dow No.	DOW acres	WR acres	Harvest trips	DNR/DU	Managed by	Wildlife coverage	NatAm	harvest potential	harvest pressure	harvest access	Comments	Management types	Outlet structure	Outlet structure comment	Owner	Owner class	WILD_RICE_	WR comments
Aitkin	White Elk	01014800	780	350	1	M	MNDNR - Wildlife/DU	Rice thickest in south half of lake, band around north side.		fair	low	easy		WLM	VC					Rice thickest in south half of lake, band around north side.
Aitkin	Rice	01006700	3,635	1,700	0		USFWS - Rice Lake NWR	Rice is located in varying degrees across entire basin.	MLIR	permit only		easy	Lake within Rice Lake National Wildlife Refuge.	WLM	VC		Federal	USFWS		Rice is located in varying degrees across entire basin.
Aitkin	Flowage	01006100	720	432	140		USACOE - Sandy Lake RA	Can include almost complete coverage of south half of lake,		good	moderate	easy	Water level managed as part of the USACE Sandy	WLM	VC		Federal	USACOE		Can include almost complete coverage of south half of
Aitkin	Mallard	01014900	354	320	185	A	MNDNR - Wildlife	Rice can cover almost all open water in basin, some holes in		good	high	easy	Lake part of Ripple River State WMA.	BDR	NatOut					Rice can cover almost all open water in basin, some holes in
Aitkin	Aitkin	01004000	850	298	11		USACOE - Sandy Lake RA	Around shoreline and outlet.		fair	low	fair	Water level managed as part of the USACE Sandy Lake Recreati	WLM	VC		Federal	USACOE		Around shoreline and outlet.
Aitkin	Shovel	01020000	230	207	36	M	MNDNR - Wildlife/DU	Rice can cover almost entire open water area of basin.		fair	moderate	fair	Primary lake access is through private land.	BDR	NatOut					Rice can cover almost entire open water area of basin.
Aitkin	Sandy River Lake	01006000	368	200	48		USACOE - Sandy Lake RA			fair	moderate	easy	Water level managed as part of the USACE Sandy Lake Recreati	WLM	VC		Federal	USACOE		
Aitkin	Minnewawa	01003300	2,451	130	24			Rice east and northwest portions of the lake.		fair	moderate	fair			FC		State	MNDNR - Waters		Rice east and northwest portions of the lake.
Aitkin	Twenty	01008500	153	119	53	M	MNDNR - Wildlife/DU	Rice can cover almost entire open water area of basin.		fair	moderate	easy		BDR	NatOut					Rice can cover almost entire open water area of basin.
Aitkin	Moose	01014000	148	117	77	A		Rice can cover almost entire open water area of basin.		good	moderate	easy	Lake adjacent to Hay Point State WMA.		NatOut					Rice can cover almost entire open water area of basin.
Aitkin	Rat House	01005300	122	100	2	M	MNDNR - Wildlife/DU	Rice can cover almost entire open water area of basin.		fair	low	fair		BDR	NatOut					Rice can cover almost entire open water area of basin.
Aitkin	Big Sandy	01006200	9,380	94	98		USACOE - Sandy Lake RA	Primarily in the Prairie River inlet flowage to lake.		fair	low	easy	Water level managed as part of the USACE Sandy Lake Recreati	WLM	VC		Unknown	USACOE		Primarily in the Prairie River inlet flowage to lake.
Aitkin	Moose River Pool	01035800	900	89			MNDNR - Wildlife			closed			Impoundment within Moose Wallow State WMA.	WLM	VC				Wild rice density is moderate (3), and its condition was goo	
Aitkin	Spruce	01015100	80	80				entire lake				difficul	1988: 76 acres. 1949: 80 acres (100%)							entire lake
Aitkin	Newstrom	01009700	97	76	5	M	MNDNR - Wildlife/DU	Rice can cover almost entire open water area of basin.		fair	low	easy	Lake within Newstrom State WMA.	BDR	NatOut					Rice can cover almost entire open water area of basin.
Aitkin	Salo Marsh State WMA Imp.	01041500	690	76			MNDNR - Wildlife			closed			Impoundment within Salo Marsh State WMA.	WLM	VC				Wild rice density is lush (4), and its condition was excelle	
Aitkin	Mud	01019400	135	68		A	MNDNR - Wildlife	Around shoreline of basin.				difficul		BDR	NatOut					Around shoreline of basin.
Aitkin	Gun	0100990C	735	60				NE bay.				easy			C					NE bay.
Aitkin	Section Ten	01011500	440	52	1	M						easy							Wild rice density is lush (4), and its condition was excelle	
Aitkin	Ripple	01014600	676	50	6			Located on east and west ends of lake, also acres on Ripple		fair	low	easy			VC					Located on east and west ends of lake, also acres on Ripple
Aitkin	Rock	01007200	366	50								easy								
Aitkin	Moose Willow WMA - Willow P(	01043100	300	50			MNDNR - Wildlife			closed			Impoundment within Moose Wallow State WMA.	WLM	VC		State	MNDNR - Wildlife		
Aitkin	Unnamed - Little Willow River W	01033200	140	50		M	MNDNR - Wildlife			closed			Impoundment within Little Willow River State WMA.	WLM	VC				Wild rice density is scattered (2), and its condition was fa	
Aitkin	Rice	01000500	83	50		M	MNDNR - Wildlife					difficul	Currently no rice: highwater - beavers. 1990: 66% rice	BDR	NatOut	BPL	Private	Private		
Aitkin	Waukenabo	01013600	819	49				Entire lake				easy	Upper end of Wankenabo: "88" - 20 to 30 yd ring around 70% o		VC		State	MNDNR - Waters		Entire lake
Aitkin	Rat	01007700	442	45	2			Largest stand in the NE.				easy			NatOut					Largest stand in the NE.
Aitkin	Elm Island	01012300	656	30	12			Primarily around inlet and outlet.		fair	low	easy			NatOut					Primarily around inlet and outlet.
Aitkin	Sjodin	01031600	43	28	6			Most of lake except center				easy			NatOut					Most of lake except center
Aitkin	Red	01010700	97	4	6			Around shore												Around shore
Aitkin	Section Twelve	01012000	167	1	5			SE and NE edges.												SE and NE edges.
Aitkin	Prairie River	01r6			34															
Aitkin	Ripple River	01r3			12															
Anoka	Carlos Avery WMA - Pool 9	W9001009	269	120			MNDNR - Wildlife							WLM	VC	DI	State	MNDNR		
Anoka	Carlos Avery WMA - Pool 3	W9001003	186	120			MNDNR - Wildlife							WLM	VC	DI	State	MNDNR		
Anoka	Hickey	02009600	41		5						low		added from state harvester survey.							
Becker	Big Basswood	03009600	586	304	6	M	R-WE		WEIR	good	low	easy					Tribal	R - WE		
Becker	Chippewa	03019600	960	288	1		USFWS - Tamarac NWR			good	high	fair		WLM	VC		Federal	USFWS - TamarackNWR		
Becker	Tamarack	03024100	2,227	245			USFWS - Tamarac NWR/WE			poor	low	easy		BDR	C		Federal	USFWS - TamarackNWR		
Becker	Rice	03020100	245	245			USFWS - Tamarac NWR/WE			good	high	easy			VC		Federal	USFWS - TamarackNWR		
Becker	Rock	03029300	1,198	240			R-WE				low									
Becker	Little Flat	03021700	235	211			USFWS - Tamarac NWR/WE		WEIR	good	high	fair			NatOut		Federal	USFWS - TamarackNWR		
Becker	Height Of Land	03019500	3,943	197	22					fair	moderate	easy	Bay inlet: 40 acres. NS: 5 acres, 5, 20, 4, 10. 30 ft frin		FC		State	MNDNR - Waters		
Becker	Flat	03024200	1,970	197	6		USFWS - Tamarac NWR/WE			good	high	fair		WLM	FC		Federal	USFWS - TamarackNWR		
Becker	Rice	03029100	245	196		M					low									
Becker	Shell	03010200	3,147	169	11	M				fair	moderate	easy	1993 data: 80 acres		VC		Private	Bob Merritt- DL		
Becker	Hubbel Pond	03024000	561	168	2	M				fair	moderate	easy			Unknown		State	MNDNR		
Becker	Spindler	03021400	185	125			USFWS - Tamarac NWR/WE		WEIR	good	high	easy		BDR	NatOut		Federal	USFWS - TamarackNWR		
Becker	Big Rat	03024600	1,102	110			R-WE		WEIR	fair	moderate	easy								
Becker	Buffalo	03035000	444	89	1		R-WE	Includes wild rice on Buffalo River.							Unknown		Federal	USFWS - TamarackNWR		Includes wild rice on Buffalo River.
Becker	Mud	03006700	88	83									1996 data							
Becker	Schultz	03027800	103	82		M							Beaver MGD							
Becker	Abners	0300390C	100	80		M	MNDNR - Wildlife/DU			good	moderate	fair		BDR						
Becker	Lower Egg	03021000	171	75	9		USFWS - Tamarac NWR/WE		WEIR	good	moderate	fair		BDR	NatOut		Federal	USFWS - TamarackNWR		
Becker	Trieglaff	03026300	111	56																
Becker	Winter	03021600	117	43			USFWS - Tamarac NWR/WE		WEIR	fair	moderate	easy		WLM	VC		Federal	USFWS - TamarackNWR		
Becker	Booth	03019800	48	43			USFWS - Tamarac NWR/WE			fair	low	fair		BDR	NatOut		Federal	USFWS - TamarackNWR		
Becker	Blackbird	03019700	284	42	4		USFWS - Tamarac NWR/WE			good	high	easy			NatOut		Federal	USFWS - TamarackNWR		
Becker	Mud	03002300	85	42			Private				low			BDR						
Becker	Two Inlets	03001700	643	40	1		Private			fair	low	easy	1995 data	BDR	FC		State	MNDNR		
Becker	Johnson	03019900	181	40			USFWS - Tamarac NWR/WE			poor	low	easy			NatOut		Federal	USFWS - TamarackNWR		
Becker	Bush	03021200	110	40			USFWS - Tamarac NWR/WE		WEIR	good	high	easy		WLM	VC		Federal	USFWS - TamarackNWR		

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County	Main Name	Dow No.	DOW acres	WR acres	Honey traps	DNR/DU	Managed by	Wildlife coverage	NWIRI	harvest potential	harvest pressure	harvest access	Comments	Management types	Outlet structure	Outlet structure comments	Owner	Owner class	WILD RICE_	WR comments
Becker	Little Basswood	03009200	105	31	5		R-WE		WEIR	fair	low	easy			FC		Federal	R - WE		
Becker	Carman	03020900	217	30	14		US FWS - Tamarack NWR/WE		WEIR	fair	moderate	fair		BDR	FC		Federal	US FWS - Tamarack NWR		
Becker	Upper Egg	03010600	493	24	10		US FWS - Tamarack NWR/WE		WEIR	poor	low	fair			NatOut		Federal	US FWS - Tamarack NWR		
Becker	Cabin	03014600	38		10		R-WE		WEIR		moderate									
Becker	Little Round	03030200	565		7	A	R-WE				low									
Becker	Unnamed (Indian Creek Impoun	03078600	13		7	M	R-WE			fair	moderate	easy			VC					
Beltrami	Big	04004900	3,565	250			R-LL/MNDNR - Fisheries	NW & W bays.	LLIR	fair	low	easy		BDR	NatOut					NW & W bays.
Beltrami	Puposky	04019800	2,120	236		M				poor	low	fair								
Beltrami	Rabideau	04013400	723	217	11	M					high	easy			FC	Old	Federal	US FWS		
Beltrami	Bootleg	04021100	308	185	8					poor	low	fair			NatOut					
Beltrami	Kitchi	04000700	1,850	185			R-LL	Creek to Little Rice.	LLIR	poor	low	fair			NatOut					Creek to Little Rice.
Beltrami	Menomin	04028600	288	144	13	M	MNDNR - Wildlife			good	moderate	fair		BDR	NatOut					
Beltrami	Pimushe	04003200	1,350	135	1	M		NW bay.	LLIR		low	fair								NW bay.
Beltrami	Three Island	04013400	836	125	2						low	easy			FC		County	Co. Park		
Beltrami	Rice Pond	04005900	247	123		M	MNDNR - Wildlife			good		easy	Within Rice Pond State Waterfowl Refuge.	BDR	NatOut					
Beltrami	Burns	04000100	131	105			R-LL		LLIR	poor	low	difficul			NatOut					
Beltrami	Irving	04014200	644	97				NW bay.				fair			NatOut					NW bay.
Beltrami	Big Rice	04003100	642	96			R-LL		LLIR	good	moderate	difficul			NatOut					
Beltrami	Moose	04001100	617	96			R-LL	N. & SW bays.	LLIR	poor	low	fair			NatOut					N. & SW bays.
Beltrami	Little Puposky	04019700	158	95		M						easy			NatOut					
Beltrami	Medicine	04012200	458	69		M		SW bay.				fair								SW bay.
Beltrami	Little Rice	04001500	123	60			R-LL	Around shoreline and inlet/outlet.	LLIR	good	low	difficul	added from lcmr.shp							Around shoreline and inlet/outlet.
Beltrami	Erickson	04006800	111	50								difficul			NatOut					
Beltrami	Cranberry	04012300	77	46	1	M					low		Early 80's data		NatOut					
Beltrami	Turtle River	04011100	1,664		15						moderate		No rice known to occur on lake, rice only in river.							
Carlton	Long	9003600						rice along shore, thick in inlet and NW portion												
Carlton	Tamarack River							good stands in several stretches												
Carlton	Perch	09003400	796	597			R-FDL		1854, FDUR				1997 data	BDR, D	VC		Tribal	R - FDL		
Carlton	Kettle	09004900	611	415	8	M	MNDNR - Wildlife		1854	good	moderate	easy		BDR, BR						surveyed annually by 1854 Treaty Authority
Carlton	Miller	09005300	156	156			R-FDL		1854, FDUR		high			BDR						
Carlton	Rice Portage	09003700	832	120	1		R-FDL		1854, FDUR		high		100 acres of open water (75% rice)	BDR, D	VC		Tribal	R - FDL		
Carlton	Dead Fish	09005100	153	115	5		R-FDL		1854, FDUR		high		1987: 75%, 1997: 50% History of beaver problems - plugged		Unknown		Tribal	R - FDL		
Carlton	Jaskari	09005000	74	74			R-FDL		1854, FDUR		high			BDR, D			Tribal	R - FDL		
Carlton	Moose Horn River	09e1	123	61	11			wide slow section of river extending from Moose Lake into Pine County												
Carlton	Tamarack	09006700	238.0	59.0								1997 data, 2009 Survey								
Carlton	Island	09006000	436	46	7						low		1997 data: 10% of Lower Island Lake							
Carlton	Tamarack Lake	9006700	228					stands in narrows and in river												
Carlton	Hay	9001000	215					rice along shore, some denser areas/bays												
Carlton	Wild Rice	9002300					Fond du Lac Reservation	sparse rice over most of lake												
Carlton	Little Kettle	9007700						can have good stands over about three-fourths of lake												
Cass	Leech	11020300	109,415	4,000	27		USACOE - Leech Lake RA	Bear I.; Blackduck & Grassy Pts; Boy, Federa Dam & Headquart	R-LL	good	high	easy		WLM	VC	USACOE dam	Federal	USACOE			Bear I.; Blackduck & Grassy Pts; Boy, Federa Dam & Headquart
Cass	Big Rice	11007300	2,717	1,411	10	M	MNDNR - Wildlife/DU	Historic coverage of approx. 60%, best stands along north an		fair	moderate	easy	State Waterfowl Feeding and Resting Area.	BDR, BR	FC	Stoplogs	State	MNDNR		Historic coverage of approx. 60%, best stands along north an
Cass	Mud	11010000	1,440	1,300	35		MNDNR - Wildlife	Found over extensive areas of the lake.	LLIR	good	high	easy	Within Mud-Goose State WMA.	WLM	VC		State	MNDNR		Found over extensive areas of the lake.
Cass	Winnibigoshish	11014700	69,821	1,000	24		USACOE - Winnibigoshish L. RA	Third River flowage (500 acres), Raven flowage (450 acres),	LLIR		high			WLM	VC	Sliding grate	Federal	USACOE		Third River flowage (500 acres), Raven flowage (450 acres),
Cass	Laura	11010400	1,424	854	9	M	MNDNR - Wildlife/DU	Northern 2/3rds of main lake and east, south bays.			fair	moderate	easy		BDR	NatOut				Northern 2/3rds of main lake and east, south bays.
Cass	Goose	11009400	844	844	7		MNDNR - Wildlife	In good years, almost 100% coverage of open water area.		good	moderate	easy	Within Mud-Goose State WMA, water levels managed by dam on M	BDR	VC	Sliding grate	State	MNDNR		In good years, almost 100% coverage of open water area.
Cass	Boy	11014300	5,544	340	3		R-LL		LLIR	good	high	easy			NatOut					Fairly continuous coverage in north bay and in a band along
Cass	George	11010100	720	262	3	M	MNDNR - Wildlife/DU	Fairly continuous coverage in north bay and in a band along		poor	low	easy		BDR	VC		State	MNDNR - Waters		
Cass	Lomish	11013600	282	197			R-LL		LLIR	good	moderate	easy		BDR	NatOut					surveyed
Cass	Rice	11016200	342	137						good	moderate	easy	1997 data							Wild rice stands can occupy up to 80% of basin area.
Cass	Gull River	11r1	219	110	5		Industrial - MN Power	It was found along the river channel throughout the surveyed			fair	low	fair		VC		Industrial	Industrial - MN Power	There were several very thick stands of Rice although most a	It was found along the river channel throughout the surveyed
Cass	Rice (Pillager)	11032100	232	100	12	A	MNDNR - Wildlife/Private	Wild rice stands can occupy up to 80% of basin area.			fair	moderate	difficul		BDR	NatOut		Private	Private		Wild rice stands can occupy up to 80% of basin area.
Cass	Lind (Lindsey)	11036700	482	95	18						fair	moderate	easy			NatOut				
Cass	McCarthey	11016800	194	78			Private				fair	low	difficul	1994 data	BDR			Private	see Ray file	
Cass	Farnham	11051300	142	71	8	M	MNDNR - Wildlife	25% in an average year to 100% in a good year.			fair	low	easy	only current public access is Potlatch land on SW corner of	BDR	NatOut		Private		typically moderate	25% in an average year to 100% in a good year.
Cass	Six Mile	11054600	1,288	70			USFS		LLIR	poor	low	fair		WLM	VC					
Cass	Washburn	11005600	1,768	60											FC		State	MNDNR - Waters		
Cass	Brookway	11036800	182	55	14					good	moderate	easy	1996 data							
Cass	Woman	11020100	5,360	54	2	M				fair	low	easy	Latern Bay, Broad Water, Narrows, Dam on Girl Lake, Otter Ba		FC		Unknown			
Cass	Swift	11013300	359	51											NatOut					
Cass	Chub	11051700	57	51			R-LL		LLIR	good	moderate	easy	Within Mud-Goose State WMA.		NatOut					
Cass	Twin	11012300	297	50		M	MNDNR - Wildlife/DU					difficul	Added to MNDNR Brainerd's management list in	BDR	C		Federal	US FWS		
Cass	Lower Hand	11025100	122	50		M	MNDNR - Wildlife	Center and eastern portions of basin, lily pads dominated we		poor	low	difficul	2007.	BDR	NatOut		County		moderate in 2007	Center and eastern portions of basin, lily pads dominated we
Cass	Lizotte	11023100	75	50			MNDNR - Wildlife	Wild rice can over a majority of basin in a good year.		fair	low	fair		BDR	NatOut					Wild rice can over a majority of basin in a good year.
Cass	Rice (Carrol's)	11022700	46	46				Wild rice can completely cover open water portion of basin.					Privately managed wild rice bed.							Wild rice can completely cover open water portion of basin.
Cass	Big Birch	11001700	255	45		M	?								NatOut					
Cass	Pine Mountain	11041100	1,657	40						fair	low	easy								
Cass	Hattie	11013200	592	40				Fair band along shoreline.												Fair band along shoreline.
Cass	Beuber	11035300	135	15	14						fair	moderate	easy	1997 Data: 150 ft fringe of rice all around						
Cass	Island	11010200	390	10	8			In various bays.											scarce	In various bays.

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County	Basin Name	Dow No.	DOW acres	WR acres	Rivers trib't	DNR/DU	Managed by	Wildlife coverage	Notes	Invest potential	Invest pressure	Invest access	Comments	Management Types	Outlet structure	Outlet structure comments	Owner	Owner class	WILD REC_	WR comments
Cass	Drumbeater	11014500	376	5	11		MNDNR - Wildlife/R-LL		LUR	poor	low	difficul	State Waterfowl Refuge.	BDR	NatOut					Practicallyno rice present.
Cass	Moose	11042400	92	1	5			Practically no rice present.			low				NatOut					
Cass	Portage	11047600	277		5															
Clearwater	Lower Rice	15013000	2,373	1,568	44		R-WE		WEIR	good	high		Good regular producer		VC		Tribal	R - WE		
Clearwater	Upper Rice	15005900	1,860	1,116	25	M	MNDNR - Wildlife/WE				high	easy	Adjacent to Upper Rice Lake State WMA.		VC	Double log	State	MNDNR - Wildlife		
Clearwater	Pine	15014900	1,465	220			Red Lake Watershed District					easy	Adjacent to Pine Lake State WMA.		VC		State	MNDNR - Fisheries		
Clearwater	Mud	15006100	294	103	17	M		wide band of rice around most of lake except pars of the wes			moderate	easy	Adjacent to Mud Lake State WMA. Potential for management, ol							wide band of rice around most of lake except pars of the wes
Clearwater	Unnamed	15002100	150	45		M						difficul								
Clearwater	Misservia	15007900	239	36	13	A	R-WE				moderate	easy								
Clearwater	Sucker	15002000	90	14	7						low	easy	Adjacent to Sucker Lake State WMA.							
Clearwater	Clearwater River	15r1			15						moderate									
Cook	Marsh	16048800	69					52 acres in 1998, less in 99-01, typically sparse to fair coverage												
Cook	Swamp River	16090100	165	153	1				1854	good	low	easy			C		State	State		
Cook	Northern Light	16008900	443	133			USFS		1854	fair		easy		WLM	FC		Federal	USFS		
Cook	Elbow	16003600	415	124	5				1854	fair	low	easy								
Cook	Rice	16045300	230	92	1				1854	fair	low	fair	1997: 92 acres (40%), normally 20% as in 1998.							
Cook	Kelly	16047600	188	56					1854	poor		difficul					Federal	USFS - BWCA		
Cook	Moore	16048000	64	48					1854	poor		easy	1997 data: very consistent in rice production - really spars							
Cook	Fourmile	16063800	593	42	2				1854	fair	low	easy								
Cook	Mark	16025000	140					can have good rice over most of lake, used by harvesters												
Cook	South Fowl	16001400	1,440					moderate to dense patches of rice												
Cook	North Fowl	16001600	1,020					moderate to dense patches of rice												
Crow Wing	Lower Dean	18018100	372	360	62	M	MNDNR - Wildlife	Wild rice can completely cover basin.		good	high	easy	Lake adjacent to Lower Dean State WMA.	BDR	NatOut					Wild rice can completely cover basin.
Crow Wing	Platte	18008800	1,768	350	1	A	MNDNR - Waters	Wild rice located in NW bay, around shoreline.		poor	low	easy		WLM	FC		State	MNDNR - Waters		Wild rice located in NW bay, around shoreline.
Crow Wing	Duck	18017800	310	175	3	M	MNDNR - Wildlife	Wild rice can completely cover open water portion of basin i		fair	low	easy	Lake within Duck Lake State WMA.	WLM	VC		State	MNDNR - Wildlife		Wild rice can completely cover open water portion of basin i
Crow Wing	Rice (Deerwood)	18006800	185	170	7	A	MNDNR - Wildlife	Wild rice densest in northern 2/3rds of basin, around shore		fair	moderate	easy		BDR	C		County	County		Wild rice densest in northern 2/3rds of basin, around shore
Crow Wing	Rice (Hositation WMA)	18005300	168	138	10	M	MNDNR - Wildlife/DU	Wild rice densest in western 2/3rds of basin.		fair	moderate	easy	Lake within Hositation State WMA.	WLM	FC		State	MNDNR - Fisheries		Wild rice densest in western 2/3rds of basin.
Crow Wing	Rice (Clark Lake)	18012700	181	124		M	MNDNR - Wildlife/DU	Wild rice can completely cover basin, open in the middle.		fair	low	fair		BDR	C		County	Co. DOT		Wild rice can completely cover basin, open in the middle.
Crow Wing	Lizzie	18041600	384	100	17			Wild rice located around east, north and outlet portion of b			low			?	FC		State	MNDNR - Waters		Wild rice located around east, north and outlet portion of b
Crow Wing	Garden	18012900	262	100	1	M	MNDNR - Wildlife/DU	Wild rice densest along east shore and north bay.		poor	low	easy		BDR	C		County	Co. DOT		Wild rice densest along east shore and north bay.
Crow Wing	Nelson	18016400	323	100				Wild rice located in west half of lake.		poor	low	fair		NA	NatOut					Wild rice located in west half of lake.
Crow Wing	Hole-in-the-Day	18040100	217	90			MNDNR - Wildlife	Wild ricels densest in northern 2/3rds of basin.		fair	low	easy	Within City of Nisswa wildlife refuge.	BDR	C			MNDOT		Wild rice is densest in northern 2/3rds of basin.
Crow Wing	Rice (Pratt's)	18031600	100	90			MNDNR - Wildlife	Wild rice can completely cover basin.		poor		difficul	Privately managed wild rice lake (Pratt).	BDR	NatOut					Wild rice can completely cover basin.
Crow Wing	Unnamed (Lost Rice)	18022800	157	80		M	MNDNR - Wildlife	Wild rice can completely cover basin.		poor	low	difficul	Large, 6' beaver dam removed in 2006, scattered rice coverag	BDR	NatOut					Wild rice can completely cover basin.
Crow Wing	Dog	18010700	71	71		M	MNDNR - Wildlife	Wild rice is found throughout the lake area in stands of var		poor	low	easy	MNDNR designated Game Lake.	BDR	VC		County	Co. DOT	Wild rice density is moderate to lush (3 ot 4), and its cond	Wild rice is found throughout the lake area in stands of var
Crow Wing	Pine	18026100	391	60				Wild rice located along east shore, Pine River channel.						NA	RO					Wild rice located along east shore, Pine River channel.
Crow Wing	Mud	18032600	82	60				Wild rice can cover a majority of open water basin.			low									Wild rice can cover a majority of open water basin.
Crow Wing	Rice (Blomberg's)	18012100	78	60				Wild rice was found throughout the open water area of the ba		fair	low	fair		NA	NatOut					Wild rice was found throughout the open water area of the ba
Crow Wing	Terry	18016200	102	55	1	M	MNDNR - Wildlife	Wild rice can cover a majority of open water portion of basi		fair	low	difficul		BDR	NatOut					Wild rice can cover a majority of open water portion of basi
Crow Wing	Upper Whitefish	18031300	7,969	50	31		USACOE - Crosslake RA						20+ lake, Pine flows into lake +30.		VC		Federal	USACOE, Part of Pine River Res. Systems		
Crow Wing	Lower Mission	18024300	739	50		A	MNDNR - Wildlife	Wild rice density was scattered to moderate (2 to 3), and it						WLM	VC					Wild rice density was scattered to moderate (2 to 3), and it
Crow Wing	Smith	18002800	486	49				Wild rice located in NW bay, west and east shorelines.							?					Wild rice located in NW bay, west and east shorelines.
Crow Wing	Rice Bed	18018700	50	47			MNDNR - Wildlife	Wild rice can completely cover basin.		fair	low	difficul		BDR	NatOut					Wild rice can completely cover basin.
Crow Wing	Lows	18018000	320	45	4	A	MNDNR - Wildlife	Wild rice located around outlet (NW) and inlet (SE).		poor	low	easy		BDR	C		Twp	Twp		Wild rice located around outlet (NW) and inlet (SE).
Crow Wing	Twentytwo	18000800	169	42				Wild rice located along NW and SE shoreline.							?					Wild rice located along NW and SE shoreline.
Crow Wing	Twin Island	18019600	85	42				Wild rice can cover a majority of open water basin.		poor	low	fair	History of 50 to 100% coverage in the 1950s & 60s.	NA	NatOut		Private			Wild rice can cover a majority of open water basin.
Crow Wing	Whipple	18038700	345	40				Wild rice exists primarily in lower basin (Moberg's Slew).												Wild rice exists primarily in lower basin (Moberg's Slew).
Crow Wing	Arrowhead	18036600	285	40			USACOE - Cross Lake RA	Wild rice in SE corner/outlet to Whitefish Lake and NE corne		poor	low	fair		WLM	VC		Federal	USACOE, Part of Pine River Res. Systems		Wild rice in SE corner/outlet to Whitefish Lake and NE corne
Crow Wing	Unnamed (Nokasippi R. Rice Bed	18048500	166	40				Wild rice can completely cover open water portion of basin.				difficul			NatOut					Wild rice can completely cover open water portion of basin.
Crow Wing	Mud	18013700	132	40		A	MNDNR - Wildlife	Wild rice located in western 2/3rds of basin.		poor	low	fair		BDR	NatOut					Wild rice located in western 2/3rds of basin.
Crow Wing	Birchdale	18017500	80	40		M	MNDNR - Wildlife	History of almost complete basin coverage, outlet structure		poor		fair		BDR	NatOut					History of almost complete basin coverage, outlet structure
Crow Wing	Little Pine	18017600	135	30	6	M	MNDNR - Wildlife	History (1960s) of harvestable stands in NE &SW corners of t		poor	low	fair		BDR	NatOut					History (1960s) of harvestable stands in NE &SW corners of t
Crow Wing	Dahler	18020400	277	28	12	M	MNDNR - Wildlife/DU	Wild rice located around shoreline.		poor	low	easy		BDR	FC					Wild rice located around shoreline.
Crow Wing	Google	18022300	107	11	6			Wild rice along outlet and outlet river channel.		poor	low	fair		NA	NatOut					Wild rice along outlet and outlet river channel.
Crow Wing	Middle Cullen	18037700	405	2	5						low				VC		Federal	USACOE, Part Gull L. Res System		
Crow Wing	Mississippi River	18r1		1	78								Brainerd dam?							
Hubbard	Mantrap	29015100	1,770	200	7		Industrial - 3M			fair	low	easy	1997	WLM	FC		Private	Industrial - 3M		
													1997 data: 200 ft fringe. Rock placed to manage							
Hubbard	Fourth Crow Wing	29007800	523	130	7					fair	low	easy	level		FC		Unknown			
Hubbard	Hart	29006300	236	118	14						moderate	easy								
Hubbard	Garfield	29006100	984	90	5			South bay.			low	easy								South bay.
Hubbard	Island	29005400	522	60	3		County			poor	low	easy	1996 data: west arm	BDR	C		County	Co. DOT		

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County	Basin Name	Dnr No.	DOW acres	WR acres	Forest SI's	DNR DU	Managed by	Wildlife coverage	Nuisfish	Survey potential	Survey pressure	Survey access	Comments	Management types	Outlet structure	Outlet structure comments	Owner	Owner class	WILD RICE_	WR comments
Hubbard	Rice	29017700	210	58	2	M	County			fair	low	difficul	1997 data	BDR	C		County	Co. DOT		
Hubbard	First Crow Wing	29008600	564	50	3					fair	low	easy	1997 data. Rack placed to manage level.		FC		Unknown			
Hubbard	Upper Mud	29028400	50	50		M				fair	low	difficul	private access.							
Hubbard	Third Crow Wing	29007700	636	40						fair	low	easy	Rack under bridge-under 109 control level							
Hubbard	Lake George	29021600	882	18	11					fair	low	easy	1997 data							
Hubbard	Lake Alice	29028600	150	15	11		County				low			BDR	C		County	Co. DOT		
Hubbard	Crow Wing	29011600	47		14															
Hubbard	Spring Lake	29005400	41		5					fair	low	difficul								
Isanti	Upper Rice	30005700	208	208									Level affected by ditch							
Itasca	Natures	31087700	2,885	2,499	89			Can cover a majority of basin in good years.	PrLL	good	high	fair			NatOut					Can cover a majority of basin in good years.
Itasca	Bowstring	31081300	8,900	1,335	26			Cow, Grouse and Muskrat bays.	LLIR	good	high	fair			NatOut					Cow, Grouse and Muskrat bays.
Itasca	Rice	31087600	911	729	1				LLIR	fair	moderate	easy	1994 data. 1997-50%. In Bowstring River		NatOut					
Itasca	Pigeon Dam	31089400	511	500			MNDNR - Wildlife		LLIR	good	high	easy		WLM	VC	Stop log	Federal	USFWS		
Itasca	Bass	31057600	2,844	427	53		MNDNR - Waters			fair	high	easy		WLM	VC	WPA dam	State	MNDNR - Waters		
Itasca	Cut Foot Sioux	31085700	3,222	322	3		USACOE - Winnibigoshish L. RA		LLIR	good	moderate	easy	1997 data. Influenced by the Winnie dam	WLM	VC	Sliding grate	Federal	USACOE		
Itasca	Blackwater	31056100	674	300	10		USACOE - Pokegemama Lake RA			fair	moderate	easy	1997. Influence by Pokegawa Dam - USACOE	WLM	VC	Sliding grate	Federal	USACOE		
Itasca	White Oak	31077600	905	271	10		USACOE - Pokegemama Lake RA	Eastern half of basin.	LLIR	fair	low	easy		WLM	VC		Federal	USACOE		Eastern half of basin.
Itasca	Mud	31020600	271	203		M				fair	low	difficul	History of beaver problems, private access.		NatOut					
Itasca	First River	31081800	228	160	14		USACOE - Winnibigoshish L. RA		LLIR	fair	low	fair		WLM	VC		Federal			
Itasca	Rabbits	31092300	209	157					LLIR	good	moderate	difficul	Bog problem, sometimes restricts outlet.		NatOut					
Itasca	Little Cut Foot Sioux	31085200	1,357	136			USACOE - Winnibigoshish L. RA		LLIR	fair	low	easy		WLM	VC		Federal	USACOE		
Itasca	Pokegama	31051200	15,600	100	6		USACOE - Pokegemama Lake RA	Primarily in Little Pokegama bay.			moderate			WLM	VC		Federal	USACOE		Primarily in Little Pokegama bay.
Itasca	Dora	31088200	477	89	11					fair	moderate	easy			NatOut					
Itasca	Helen	31084500	109	76								difficul			NatOut					
Itasca	Ravin	31092500	97	70		M	PrLL		LLIR	good	low	difficul	History of beaver problems.	BDR	7	BPL	Tribal	R - LL		
Itasca	Dixon	31092100	666	67	3		MNDNR - Wildlife/Dixon LA				low	easy		BDR	NatOut					
Itasca	Decker	31093400	292	58		M	MNDNR - Wildlife/Dixon LA					easy		BDR	NatOut		Cooperative	SWCD, Dickson Lake Association		
Itasca	Spruce	31014700	58	58								easy			NatOut					
Itasca	Swan	31006700	2,472	50	11						moderate				NatOut					
Itasca	Blackberry	31021000	240	50	2	M	MNDNR - Wildlife/DU			fair	low	fair	Also private management- lakeshore owners.	BDR	C		County	County		
Itasca	Sand	31082600	3,191	50											NatOut					
Itasca	Nagel	31017700	90	50		M						difficul			NatOut					
Itasca	Prairie	31038400	1,167	45								fair			NatOut					
Itasca	Prairie	31005300	29	1	31		Industrial - MN Power				high		1997 data	BDR	Dam		Industrial	Industrial - MN Power		
Itasca	Mississippi River	31r5			74															
Itasca	Big Fork River	31r3			18						moderate									
Itasca	Bowstring River	31r4			7															
Koochiching	Nett	36000100	7,301	2,000	20				NLIR											
Koochiching	Net Root	36000600	734		9						low		added from state harvester survey.							
Lake	Basswood	38064500	14,610	485				Black, Hoist, Rice, and Wind bays.		fair		difficul	1982 data - Back bay: 150 acres, Wind bay: 200 acres, Hoist							Black, Hoist, Rice, and Wind bays.
Lake	Stony	38066000	409	245	12					fair	moderate	difficul								
Lake	Garden	38078200	4,236	212	2		Industrial - MN Power				low		1997 data	WLM	VC		Industrial	Industrial - MN Power		
Lake	Rice	38046500	206	206									1987 data							
Lake	Bonga	38076200	138	138									1987 data							
Lake	Wood	38072500	587	125				NE Bay and Maddem Cr. Bay lush, other areas scattered.		fair		difficul							Wild rice density is moderate (3), and its condition was goo	NE Bay and Maddem Cr. Bay lush, other areas scattered.
Lake	Hula	38072800	121	121	3			Rice lush in bay by portage coming from Wood Lake.			low	difficul							Wild rice density is sparse (1), and its condition was fair	Rice lush in bay by portage coming from Wood Lake.
Lake	Lobo	38076600	132	99									1992 data							
Lake	Muskeg	38078800	178	71						poor		difficul	1970 data. Beaver problems				Federal	USFS - BWCA		
Lake	Round Island	38041700	58	58	10	A	MNDNR - Wildlife/PrFDL	Can completely cover basin.	1854	good	moderate	fair		BDR						Can completely cover basin. Surveyed annually by 1854 Treaty Auth
Lake	Campers	38067900	56	56	13	M		Can cover a majority of basin.		fair	moderate	fair								Can cover a majority of basin. Surveyed annually by 1854 Treaty Auth
Lake	Cramer	38031400	69	55	15			?	1854	fair	moderate	easy							Average # stalks per 0.5 sq. meters is 21-40.	surveyed annually by 1854 Treaty Authority
Lake	Cabin	38026000	71	55	4	M		Can cover a majority of basin.	1854	good	moderate	fair							Average # of stalks per 0.5 sq. meter is 0-20.	Can cover a majority of basin. Surveyed annually by 1854 Treaty Auth
Lake	Sand	38073500	506	51	5					poor	low	fair								
Lake	Snowbank	38052900	4,819	50									One bay has rice, 50 acres at most							
Lake	Island River	38084200	49	49	6					good	low	easy								
Lake	Dunnbbell	38039300	476	48					1854	fair		easy								
Lake	Clark	38064700	49		13	A			1854	fair	moderate	fair								
Lake	Cloquet	38053900	176		10						low		added from 1854M list.							
Lake	Greenwood	38065600	1,300					good stand on N end, rice coverage on S end also												
Lake	Farm	38077900	1,292					fair potential in some areas?, no field date												
Lake	Moose	38003600	201					rice coverage over most of lake												
Lake	Gegoka	38057300	176					moderately dense on N end, along shore, about 1/4 covered												
Lake	Hoist	38025100	113					typically over half to completely covered with rice												
Lake	Hjalmer	38075800	109					rice over about three-fourths of lake												
Lake	Middle McDougal	38065800	108					over-third to three-fourths coverage												
Lake	Phantom							5?-56N, 10W - most of lake covered												
Lake of the Woods	Rosseau Flowage	39MP001	200	100			MNDNR - Wildlife						Rice acres have drastically declined in late 1990's	WLM	VC	DI	State	MNDNR		
Lake of the Woods	Rainy River	39r5			12						low		added from state harvester survey.							
Lake of the Woods	Winter Road River	39r4			6						low		added from state harvester survey.							
Mille Lacs	Onamia	48000900	2,250	1,350	38		MNDNR - Wildlife				high		1964- 1350 acres of rice		VC		State	MNDNR - Waters		
Mille Lacs	Ernst Pool	48003600	300	200									Very good stand but poor seed production again this year.						Wild rice density is lush (4), and it conditions was fair (2	
Mille Lacs	Dewitt Marsh	48002000	110	131			MNDNR - Wildlife							BDR	VC		State	MNDNR - Wildlife		

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County	Basin Name	Dow No.	DOW acres	WR acres	Harvest trips	DNR EAU	Managed by	Wildlife coverage	Nuisfish	harvest potential	harvest pressure	harvest access	Comments	Management Types	Outlet structure	Outlet structure comments	Owner	Owner class	WILD RICE_	WR comments
Morrison	Skunk	49002600	320	256	A		MNDNR - Wildlife	Throughout lake.		fair	low	easy	Water levels managed by outlet dam on Platte River, Rice Lak	WLM	VC		State	MNDNR - Wildlife		Throughout lake.
Morrison	Rice	49002500	323	250	A		MNDNR - Wildlife	Excellent coverage at spots along shoreline in Rice Lake & n		fair	low	easy	Water levels managed by outlet dam on Platte River, Rice Lak	WLM	VC		State	MNDNR - WildlifeMNDNR - Wildlife		Excellent coverage at spots along shoreline in Rice Lake & n
Morrison	Twelve	49000600	159	80								difficul	Private across.				Private	Private		
Morrison	Coon	49002000	75	75									Lake within Coon Lake State WMA.						common	
Otter Tail	Ottertail River	56r1			33															
Otter Tail	Lake Sixteen	56010000	107		5															
Otter Tail	Star	56038500	48910					historic rice camp												
Pine	Crooked	58002600	94	85	5						low		1989 Survey							
Pine	Hay Creek Flowage	58000500	66	40	5						low				FC		State	MNDNR - Waters		
Pine	Willow River	58r1			6						low		added from state harvester survey.							
Rice	Mud	66005400	269	54									Rice has bees observed intermittently, also noticed on past				State	MNDNR - Wildlife		
Scott	Fisher	70008700	396	190			USFWS - Minnesota Valley NWR				closed		Typically 50 acres of rice, reaches 200 acres in good years.		C		Federal	USFWS		
Scott	Rice	70002500	328	160			USFWS - Minnesota Valley NWR				closed		Typically 35 acres of rice, reaches 160 acres in good years.		C		Federal	Coop - USFWS, Private		
Scott	Blue	70008800	316	120			USFWS - Minnesota Valley NWR				closed		Typically 20 acres of rice, reaches 120 acres once every 12-		C		Federal	USFWS		
Sherburne	Orrock	71MP010	215	162			USFWS - Sherburne NWR						Natural lake				Federal	USFWS - Sherburne NWR		
Sherburne	Rice		487	187			USFWS - Sherburne NWR	good rice crop in 2009												
Sherburne	Schoolhouse Pool	71MP009	225	90			USFWS - Sherburne NWR							WLM	VC	Type "C"	Federal	USFWS - Sherburne NWR		
Sherburne	Josephine Pool	71MP008	143	72			USFWS - Sherburne NWR						Natural lake that was ditched	WLM	VC	Type "C"	Federal	USFWS - Sherburne NWR		
St. Louis	Knuckey	69080000	71					lake can be about one half covered, some use by harvesters												
St. Louis	Lapond	69017700	176	176		M				fair		difficul	1972 data (100%), now 5% rice							
St. Louis	Big Rice	69066900	2,072	1,700	64		MNDNR - Wildlife	Throughout lake, typically open in the center.	1854	good	high	easy	Outlet and pidenelivered control issues. Seeded by Forest Service in 1985. Possible old logging dam.	BDR	FC		State	MNDNR - Wildlife		Throughout lake, typically open in the center. Surveyed annually by 1854 Treaty Auth
St. Louis	Seven Beaver	69030200	1,508	1,282	3		USFS	Best rice is located in the narrows and south bay of lake, b		good	low	difficul		BDR	FC		Federal	USFS		Best rice is located in the narrows and south bay of lake, b
St. Louis	Crane	69061600	1,396	600	1						low									
St. Louis	Vermilion River	69061300	1,125	562	66			?		good	high	easy								surveyed annually by 1854 Treaty Authority
St. Louis	Big Rice	69017800	416	416		M				fair	high	difficul	1977 data, now 4 acres (1%).							
St. Louis	Butterball	69004400	442	400	1		MNDNR	No thick beds of rice this year with rice across most of the		good	low	difficul		BDR			State	MNDNR		No thick beds of rice this year with rice across most, also called Long
St. Louis	Birch	69000300	7,628	381	5		Industrial- MN Power			good	low	easy		WLM	VC		Industrial	Industrial- MN Power		
St. Louis	Little Rice	69061200	266	266	31		MNDNR - Wildlife	Can completely cover basin.		fair	high	easy		BDR	C		State	MNDOT		Can completely cover basin. Surveyed annually by 1854 Treaty Auth
St. Louis	Hoodoo	69080200	252	252	3	M	MNDNR - Wildlife	Rice found over the entire lake at various densities from ra			low		1997 data	BDR						Rice found over the entire lake at various densities from ra
St. Louis	Vermillion	69037800	49,110	250			Dam?			poor		easy	Pike Bay: historicaly heavy rice, 250 acres, before structure, Rice Bay also		FC		State	MNDNR - Waters		
St. Louis	Sturgeon	69093900	2,050	243			County						CCC program	BDR	VC	WPA dam	County	County		
St. Louis	Stone	69006600	230	173	54		MNDNR - Wildlife	?			moderate			BDR			State	State		surveyed annually by 1854 Treaty Authority
St. Louis	Breda	69003700	137	135	66	A		Can completely cover basin in good years.	1854	good	high	fair							Average # of stalks per 0.5 sq. meter is 61-80.	Can completely cover basin in good years. Surveyed annually by 1854 Treaty Auth
St. Louis	Bear	69011200	125	125					1854				1994 Survey data							
St. Louis	Sandy	69073000	121	121			MNDNR	historic good crops, (Twin Lakes)					1982 data. Used to manage but quit in 1992.	BDR	C		State	State		
St. Louis	Pelican	69084100	11,944	119	16						moderate		Not managed currently		VC	WPA dam	County	County		
St. Louis	Hay	69057900	114	114			MNDNR - Wildlife							BDR			Federal	USFS		
St. Louis	Shannon	69092500	135	108	5	M		Best rice located at outlet of lake with some fringe rice on			low		1996 data				Federal	USFS		Best rice located at outlet of lake with some fringe rice on
St. Louis	Leeman	69087500	284	90			Private, now public?						1997 data	BDR			Private	Private		
St. Louis	Little Sandy	69072900	89	89				historic good crops, (Twin Lakes)					1982 data: mining tailings over flow. Used to manage, quit							
St. Louis	Stone	69003500	87	85		M	Twp		1854					BDR	C		Twp	Twp		also called Tommila Lake
St. Louis	Canosia WMA, Angell Pool	W0089905	500	80			MNDNR - Wildlife						1997 data. Seeded with 300 lbs in 1988			BPL	State	MNDNR - Wildlife		
St. Louis	Hay	69043500	78	78			MNDNR - Wildlife	little rice in 2009- Barr Eng (PolyMet)					Historically good rice but not since the 60's. Coop: County	BDR	VC		Cooperative	Coop - County, DNR - WL, FDL		
St. Louis	Low	69007000	353	71	2			only sparse rice plants in 2002		poor	low	easy	Data 1960's, currently 0% - beaver problems							
St. Louis	Hockey	69084900	139	70	9						low									
St. Louis	Moose	69079800	82	62	36		MNDNR - Wildlife			fair	moderate	fair	Excellent bed of rice still no good access to lake due to ne	BDR	C		County	County		
St. Louis	Turpela	69042700	76	61		M				poor		difficul					County	County		
St. Louis	Bag	69053100	71	53								difficul	1985 data							
St. Louis	Wabuse	69040800	64	51			MNDNR - Wildlife			fair		difficul	1997 data. Managed by Eveleth.	BDR						
St. Louis	Dollar	69053400	51	51			MNDNR - Wildlife						Rice seems not to be able to expand due to other aquatic veg	BDR						
St. Louis	Hay	69041700	82	45				Best stand is on the east end of lake with the rice continui					1972 data: 100 % (41 acres) Forest Service						Wild rice density is moderate (3), and its condition was goo	Best stand is on the east end of lake with the rice continui
St. Louis	Mud	69079700	43	43			MNDNR - Wildlife			poor		difficul	seeded in 1992.	BDR	C		County	County		
St. Louis	Rice	69057800	41	41			MNDNR - Wildlife	Good rice bed across lake and downstream.					1996 data	BDR			Federal	USFS		Good rice bed across lake and downstream.
St. Louis	Washusk Number One	69090900	51	40			MNDNR - Wildlife			fair		difficul	1997 data. Managed by Eveleth.	BDR						
St. Louis	Rainy	69069400	220,800		17						low		Unknown rice production							
St. Louis	Wolf	69014300	456		17	M			1854	fair	moderate	difficul								
St. Louis	Saint Louis River	69r2			14			headwaters, Norway Pt, historic in estuary	1854	fair	moderate	easy								
St. Louis	Pike River	69r1			9				1854	fair	low	easy								
St. Louis	Burntside	69011800	7,314					fair potential in some areas?, no field data												
St. Louis	Anchor	69064100	316					thicker rice in narrow sand back bays, around 20% coverage												
St. Louis	Rice	69018000	110					64N, 13W - fair potential for rice?, no field data, BWCA lake												
St. Louis	East Stone	69063800	80					can be half covered with good density												

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County	Basin Name	Dnr No.	DOW acres	WA acres	Harvest trips	DWR_DU	Managed by	Wildlife coverage	Nuisfin	harvest potential	harvest pressure	harvest access	Comments	Management types	Outlet structure	Outlet structure comments	Owner	Owner class	WILD_REC_	WA comments
St. Louis	Little Indian Sioux River							64N, 15W – good stands along banks, used by harvesters												
St. Louis	Papoose	69002400						can have thick rice over entire lake, some use by harvesters												
St. Louis	Petrel Creek							58N, 12W – thick rice in areas, used by harvesters into Breda L												
St. Louis	Sand River							60N, 16W – can contain good stands												
St. Louis	Washusk #2							55N, 15W – rice along shore, sparse in center												
St. Louis	Partridge River							58N, 14-15W – number of stands with good density												
St. Louis	Rice							64N, 19W – can have thick rice over entire lake (2007, 2008)												
Stearns	Tamarack	73027800	470	235				island clumps throughout					Wild rice was planted by the Belgrade Sportsmen's Club in 19				State	MNDNR – Wildlife		Island clumps throughout
Todd	Long	77006900	356	338	1	M	MNDNR – Wildlife	Typically thickest in north portion of lake, more spotty in	fair	low	easy		Water influenced by Turtle Creek watershed. Lake adjacent to	BDR	NatOut		Cooperative	Private, State		Typically thickest in north portion of lake, more spotty in
Todd	Mud	77008700	398	318		M	MNDNR – Wildlife	Rice typically around shoreline, can cover almost all of ope	fair	low	fair		Water influenced by Turtle Creek watershed. Lake within Turt	BDR			Private	Private		Rice typically around shoreline, can cover almost all of ope
Todd	Twin	77002100	317	159		M					fair		County ditch outlet on west side. Access thru Ostendorf Stat				Cooperative	Private, Public		
Todd	Rogers	77007300	185	130	1	M		Typically in a wide band around shoreline.		low	difficul		Affected by county ditch, flows into Long Lake, outlet has c		C		Private	Private		Typically in a wide band around shoreline.
Todd	Nelson	77000500	84	70		M		Entire lake.			difficul		Private access.						Wild rice density is lush (4) to rank(5), and its condition	Entire lake.
Todd	Rice	77006100	675	60		M		Most of rice on south end where connected to Thunder Lake.	fair	low	difficul		Problems with water from Turtle Creek watershed.				Cooperative	Private, Public		Most of rice on south end where connected to Thunder Lake.
Wabasha	Zumbro River							Zumbro Bottoms, McCarthy Lake – acreage, wildlife value												
Wadena	Yanger	80002200	384	346		M	MNDNR – Wildlife	Entire lake, best stands are located on west side & across t	fair	moderate	easy			BDR	VC		State	MNDNR – Wildlife		Entire lake, best stands are located on west side & across t
Wadena	Burgen	80001800	92	86			MNDNR – Wildlife	Covers 93% of water area.	poor	low	difficul						Private	Private		Covers 93% of water area.
Wadena	Strike	80001300	76	76				1988: sparce rice. 1963 100% covered.	fair	low	difficul									1988: sparce rice. 1963 100% covered.
Wadena	Round	80001900	58	58		A	MNDNR – Wildlife/DU		fair	moderate	fair		1993	BDR						
Wadena	Greening	80001200	50	50				Entire lake.		low	fair		1988 Sparce rice. 1963: 50 acres of rice (100%)							Entire lake.
Wadena	Blueberry	80001400	555.0	10.0				historic wild rice camp												
Waseca	Everson	81002700	79.0	20.0				Stand around perimeter of the lake between cattail/phrag, fringe and open water. Varies in size and density year to year.					Stand was only about 10 acres in 2009							
Waseca	Lilly	81006700	125.0	38.0				Dense stand around perimeter of the basin												
Wright	Sandy	86022400	118	150				Entire lake.					Within Sucrosix State WMA.						In 2004, wild rice density was moderate (3) and in fair (2)	Entire lake.

Appendix E

Details of Wild Rice Surveys on Swan Lake Southwest Bay and Swan River

Swan Lake
19-Aug-10

Grid 7			Grid 6			Grid 8			Grid 9			Total Lake Stem Statistics	
	Stems	Height		Stems	Height		Stems	Height		Stems	Height	Grid	Stem Number
Plot 50	20	81	Plot 19	45	112	Plot 91	14	110	Plot 81	7	98	Grid 6	45
5236778 N		84	5236749 N		75	5236609 N		53	5236485 N		82		8
484220 E		86	484086 E		100	484183 E		82	484174 E		71		49
		105			118			87			73		23
		110			93			71			66		20
													8
Plot 29	22	156	Plot 14	8	65	Plot 41	10	51	Plot 82	1	100		39
5236780 N		120	5236749 N		51	5236609 N		58	5236485 N				17
484219 E		56	484081 E		55	484178 E		48	484175 E				25
		129			125			38					14
		113			39			47					32
													18
													15
Plot 39	34	85	Plot 50	49	96	Plot 52	0	0	Plot 71	15	84		3
5236779 N		135	5236746 N		111	5236610 N			5236486 N		82		50
484219 E		126	484087 E		82	484179 E			484174 E		63		21
		113			97						112		30
		128			107						103		6
													79
Plot 59	0	0	Plot 49	23	72	Plot 11	0	0	Plot 51	6	93		35
5236776 N			5236746 N		100	5236609 N			5236488 N		85	Grid 7	20
484219 E			484086 E		122	484175 E			484174 E		79		22
					67						69		34
					98						48		0
													12
Plot 69	12	128	Plot 79	20	77	Plot 4	0	0	Plot 22	13	100		35
5236775 N		119	5236743 N		93	5236612 N			5236491 N		103		26
484219 E		91	484086 E		108	484174 E			484175 E		65		8
		124			108						98		15
		130			99						57		52
													27
													26
Plot 57	35	112	Plot 90	8	91	Plot 33	0	0	Plot 11	7	65		0
5236776 N		137	5236742 N		90	5236611 N			5236492 N		80		1
484217 E		117	484087 E		92	484177 E			484174 E		74		15
		109			95						61		61
		124			71						28		69
													39
													32

Grid 7			Grid 6			Grid 8			Grid 9			Total Lake Stem Statistics	
	Stems	Height		Stems	Height		Stems	Height		Stems	Height	Grid	Stem Number
Plot 97	26	104	Plot 99	39	99	Plot 43	3	80	Plot 3	11	93		30
5236772 N		115	5236741 N		116	5236611 N		50	5236493 N		98	Grid 8	14
484217 E		102	484086 E		131	484178 E		22	484176 E		48		10
		75			128						43		0
		130			93						49		0
													0
Plot 46	8	161	Plot 77	17	58	Plot 64	14	66	Plot 53	4	59		0
5236778 N		149	5236743 N		49	5236612 N		71	5236488 N		83		3
484216 E		118	484084 E		77	484180 E		74	484176 E		107		14
		78			97			56			70		6
		114			107			53					19
													19
													25
Plot 26	15	48	Plot 48	25	77	Plot 74	6	48	Plot 54	9	95		23
5236780 N		109	5236746 N		67	5236612 N		81	5236488 N		96		15
484216 E		125	484085 E		80	484181 E		90	484177 E		94		7
		109			85			73			114		0
		100			104			50			58		17
													14
Plot 25	52	74	Plot 35	14	100	Plot 84	19	64	Plot 95	23	122		0
5236780 N		137	5236747 N		108	5236612 N		70	5236484 N		79		1
484215 E		124	484082 E		74	484182 E		66	484178 E		81	Grid 9	7
		115			115			58			97		1
		118			100			71			100		15
													6
													13
Plot 35	27	93	Plot 45	32	98	Plot 85	19	64	Plot 76	20	91		7
5236779 N		127	5236746 N		113	5236613 N		70	5236486 N		86		11
484215 E		108	484082 E		68	484182 E		66	484179 E		98		4
		128			112			58			121		9
		126			94			71			115		23
													20
													18
Plot 55	26	135	Plot 75	18	109	Plot 76	25	83	Plot 55	18	128		19
5236776 N		110	5236743 N		112	5236614 N		72	5236488 N		71		0
484215 E		121	484082 E		120	484181 E		103	484178 E		98		7
		142			98			96			93		0
		94			105			92			70		0
													4
													4
Plot 74	0	0	Plot 86	15	109	Plot 46	23	118	Plot 35	19	91		6

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Grid 7			Grid 6			Grid 8			Grid 9			Total Lake Stem Statistics	
	Stems	Height		Stems	Height		Stems	Height		Stems	Height	Grid	Stem Number
5236774 N			5236742 N		97	5236614 N		129	5236490 N		123		
484214 E			484083 E		107	484178 E		87	484178 E		88		
					90			62			97		
					70			44			89		
Plot 62	1	75	Plot 94	3	97	Plot 26	15	60	Plot 25	0	0		
5236775 N			5236741 N		93	5236614 N		81	5236491 N				
484212 E			484081 E		34	484176 E		62	484178 E				
								59					
								45					
Plot 61	15	138	Plot 73	50	118	Plot 57	7	59	Plot 77	7	76		
5236775 N		97	5236743 N		160	5236615 N		82	5236486 N		91		
484211 E		102	484080 E		90	484179 E		109	484180 E		83		
		109			119			38			45		
		125			87			58			75		
Plot 51	61	167	Plot 32	21	107	Plot 87	0	0	Plot 87	0	0		
5236776 N		151	5236747 N		131	5236615 N			5236485 N				
484211 E		134	484079 E		128	484182 E			484180 E				
		126			90								
		92			124								
Plot 31	69	124	Plot 41	30	113	Plot 25	17	77	Plot 97	0	0		
5236779 N		139	5236746 N		120	5236613 N		80	5236484 N				
484211 E		121	484078 E		113	484176 E		71	484180 E				
		123			118			82					
		134			121			66					
			Plot 72	6	100								
Plot 33	39	140	5236743 N		120	Plot 10	14	71	Plot 60	4	82		
5236779 N		143	484079 E		97	5236618 N		72	5236488 N		124		
484213 E		96			124	484174 E		43	484183 E		52		
		138			99			48			46		
		148						54					
			Plot 81	79	162								
Plot 12	32	157	5236742 N		121	Plot 50	0	0	Plot 30	4	105		
5236781 N		151	484078 E		159	5236618 N			5236491 N		73		
484212 E		98			123	484178 E			484183 E		72		

Grid 7			Grid 6			Grid 8			Grid 9			Total Lake Stem Statistics	
	Stems	Height		Stems	Height		Stems	Height		Stems	Height	Grid	Stem Number
		120			109						39		
		76											
			Plot 92	35	133								
Plot 1	30	145	5236741 N		114	Plot 60	1	45	Plot 20	6	94		
5236782 N		113	484079 E		137	5236618 N			5236492 N		62		
484211 E		134			140	484179 E			484183 E		68		
		120			115						90		
		143									59		

	Stems	Height		Stems	Height		Stems	Height		Stems	Height		Stems
Total	524	10086	**Total**	537	9892	**Total**	187	4365	**Total**	174	6420	**Total**	1422
Mean	26.2	114.61	**Mean**	26.85	100.94	**Mean**	9.35	62.36	**Mean**	8.7	79.26	**Mean**	17.775
Median	26	120	**Median**	22	100	**Median**	8.5	65	**Median**	7	82	**Median**	15
S.D.	19.07	29.15	**S.D.**	18.66682	24.01	**S.D.**	8.66	27.17	**S.D.**	7.12	26.53	**S.D.**	16.70668403

Appendix F

Photographs of Swan Lake Southwest Bay and Swan River

Figure F-1 Swan Lake Southwest Bay, View of Eastern Shore, July 18, 2010

Figure F-2 Swan Lake Southwest Bay, View of Eastern Shore, July 18, 2010

Figure F-3 Swan Lake Northwest Grid Location, July 18, 2010

Figure F-4 Swan Lake Southwest Bay, Grids Located in Lake's Center, July 18, 2010